SECTION 9

TECHNOLOGY OPTIONS CONSIDERED AS THE BASIS OF THE REGULATION

This section presents the technology options considered by EPA as the basis for the final effluent limitations guidelines and standards for the iron and steel industry. The limitations and standards discussed in this section are Best Practicable Control Technology Currently Available (BPT), Best Conventional Pollutant Control Technology (BCT), Best Available Technology Economically Achievable (BAT), New Source Performance Standards (NSPS), Pretreatment Standards for Existing Sources (PSES), and Pretreatment Standards for New Sources (PSNS).

In developing the final regulation, EPA used a focused rulemaking approach, conducting several data gathering and analysis activities concurrently and assessing only a limited number of technology options. This is unlike the traditional approach where EPA conducts these efforts consecutively and considers a wider range of wastewater management and treatment technology options. This focused rulemaking approach is feasible for the iron and steel regulation because the Agency has acquired a good understanding of the industry, its associated pollutants, and the available control and treatment technologies from its prior rulemaking efforts. EPA evaluated responses to industry surveys, data collected from Agency site visits and sampling episodes, and technical literature to determine "state-of-the-art" pollution control technologies to form the bases of the technology options considered for the final rule. EPA's technology options incorporate pollutant control technologies that demonstrate effective use in the iron and steel industry (i.e., consistent effluent quality with a high degree of pollutant reduction for pollutants of concern, supported by analytical data), minimize water use, and result in minimal non-water quality environmental impacts. The Agency did not perform detailed analyses on pollution control technologies that, after preliminary analyses, were determined to require significant capital and operating and maintenance costs without substantial pollutant removals. Because of the focused rulemaking approach, generally only one option (in addition to a regulatory option not to revise) is presented for each subcategory. Furthermore, the presented option usually is an improvement in water management and operation of the wastewater treatment technologies that are currently used by the industry.

Extensive stakeholder involvement was also an important element of the focused rulemaking process. EPA met with industry representatives, citizen and environmental groups, and other stakeholders at various stages of the rulemaking process to discuss the preferred technology options and to identify issues of concern. Input from stakeholders allowed EPA to refine its final technology options.

While EPA establishes effluent limitations guidelines and standards based on a particular set of in-process and end-of-pipe treatment technology options, EPA does not require a discharger to use these technologies. Rather, the technologies that may be used to treat wastewater are left entirely to the discretion of the individual treatment plant operator, as long as the facility can achieve the numerical discharge limitations and standards, as required by Section §301(b) of the Clean Water Act. Direct and indirect dischargers can use any combination of process modifications, in-process technologies, and end-of-pipe wastewater treatment technologies to achieve the effluent limitations guidelines and standards.

Sections 9.1 through 9.7 present descriptions of the technology options evaluated for the final effluent limitations guidelines and standards in each subcategory. Tables 9-1 through 9-7 show the in-process and end-of-pipe treatment used in industry as reported in the U.S. EPA Collection of 1997 Iron and Steel Industry Data (detailed and short surveys).

9.1 Cokemaking

9.1.1 By-Product Recovery Cokemaking

Best Practicable Control Technology Currently Available (BPT)

EPA is not revising any existing BPT limitations for the by-products recovery segment of this subcategory (which, in the 1982 regulation, was divided between "iron and steel" and "merchant" coke plants).

Best Conventional Pollutant Control Technology (BCT)

EPA is not revising any existing BCT limitations for the by-products recovery segment of this subcategory (which, in the 1982 regulation, was divided between "iron and steel" and "merchant" coke plants) because EPA identified no technologies that achieve greater removals of conventional pollutants than the technology basis for the current BPT and that pass the BCT cost test.

Best Available Technology Economically Achievable (BAT)

Of the iron and steel subcategories, by-product recovery cokemaking has the widest range of treatment technologies used by the industry. During the development of this rulemaking, EPA considered four BAT options for direct discharging by-product recovery cokemaking facilities. The four options rely on a combination of physical/chemical and biological treatment to reduce the discharge of pollutants from by-product recovery cokemaking facilities. The four technology options are:

- Option 1 (BAT-1): Emission control scrubber blowdown to coke quench stations, oil and tar removal, flow equalization prior to ammonia distillation (stripping), free and fixed ammonia distillation (stripping), indirect cooling, flow equalization before biological treatment, biological treatment and secondary clarification, and sludge dewatering;

- Option 2 (BAT-2): BAT-1 treatment with cyanide precipitation and sludge dewatering prior to biological treatment;

- Option 3 (BAT-3): BAT-1 with breakpoint chlorination following biological treatment; and

- Option 4 (BAT-4): BAT-3 with multimedia filtration and granular activated carbon after breakpoint chlorination.

As discussed in the 2000 proposal, EPA dropped BAT-2 and BAT-4 from further consideration because BAT-2 is a proprietary technology which would make costs and economic achievability difficult to predict, and BAT-4 achieves pollutant removals equivalent to BAT-3 but was much more costly. Therefore, for the final rule, EPA considered only BAT-1 and BAT-3 as the basis for revising the cokemaking subcategory effluent limitations guidelines and standards. Figures 9-1 and 9-2 show the BAT-1 and BAT-3 treatment systems considered for the 13 direct discharging by-product recovery cokemaking facilities. The following discussion explains each option in further detail.

BAT-1 is based on free and fixed ammonia distillation (stripping), or ammonia stills, and biological treatment with nitrification. Free and fixed ammonia distillation (stripping) is designed to remove free and fixed forms of ammonia and cyanide. In addition, it can also remove significant amounts of volatile and semi-volatile organics, such as naphthalene. Ammonia stills are tray-type distillation towers that use steam to strip the ammonia out of the waste ammonia liquor. Stills typically have two ‘legs’ for maximum ammonia removal. First, free ammonia is removed in the free leg, followed by conversion of the fixed ammonia by addition of lime, sodium hydroxide or soda ash. The converted ammonia is then removed in the fixed leg. The effectiveness of ammonia distillation depends greatly on efficient tar removal and equalization prior to the still. The efficiency of the still corresponds to the number of trays that the liquid must pass over before reaching the bottom. The tower diameter is a function of the wastewater flow rate. As shown in Table 9-1, 12 of the 13 direct discharging facilities use ammonia stills.

A second key component, biological treatment with nitrification, is designed to remove any additional ammonia, cyanide, phenol, and organic pollutants such as benzo(a)pyrene and naphthalene. The effectiveness of biological treatment depends on proper equalization and influent temperature prior to the biological treatment tank. Many sites use equalization tanks and heat exchangers ahead of the aeration basin. The sludge retention time (SRT) is also a key component for efficient operation. Nitrification is needed to remove ammonia. Efficient clarification following biological treatment is required to collect the microorganisms (activated sludge) for return to the aeration basin, as well as to lower the solids content in the effluent. Sound monitoring and operation of the biological system is also necessary. Air diffusers must be checked and cleaned to provide a consistent dissolved oxygen supply in the aeration basin. Excess biomass (sludge) must be wasted to maintain a constant microbe population in the system.

Biological treatment, used by 12 of the 13 direct dischargers, is the most common treatment technology at by-product recovery coke manufacturers. Ten of these sites use conventional activated sludge systems; two sites use biofiltration as shown in Table 9-1. One direct discharger uses physical-chemical treatment rather than biological treatment.

BAT-3 is the same as BAT-1 with an additional breakpoint chlorination step. Breakpoint chlorination uses sodium hypochlorite or chlorine gas in a carefully controlled pH environment to remove ammonia, although incidental removals of cyanide and phenols will occur. The ammonia oxidizes to nitrogen gas, hydrochloric acid, and water; cyanide oxidizes to bicarbonate and nitrogen gas. The breakpoint chlorination reaction must occur at carefully controlled pH levels and has the possibility of chemical interferences when treating mixed wastes. Although U. S. cokemaking facilities do not use breakpoint chlorination, foreign facilities have successfully used this technology to treat cokemaking wastewater. EPA ultimately rejected BAT-3 for the reasons set forth in Section VIII.A.3.a of the preamble to the final rule.

For the final iron and steel regulation, EPA established BAT limitations for the by-product cokemaking subcategory based on BAT-1. EPA has concluded that the BAT-1 treatment system represents the best available technology economically achievable for this segment of this subcategory. There are several reasons supporting this conclusion. First, the BAT-1 technology is readily available to all cokemaking facilities. Approximately 75 percent of the facilities in this segment currently use it. Second, the BAT-1 technology will ensure a high level of removal of all cokemaking pollutants of concern. Well-operated free and fixed ammonia stills will remove gross amounts of ammonia-N, cyanide, and many organic pollutants while biological treatment with nitrification followed by secondary clarification will remove more ammonia-N, total phenolics (4AAP), and other organic constituents of the wastewater to low levels. Third, adoption of this level of control would represent a significant reduction in conventional, nonconventional, and toxic pollutants discharged into the environment by facilities in this subcategory. Even though 75 percent of the facilities currently employ this technology, EPA predicts significant removals attributable to this rule because the limitations reflect substantial improvements in how these technology components are designed and operated. Finally, EPA has evaluated the economic impacts associated with this technology and found it to be economically achievable.

New Source Performance Standards (NSPS)

The Agency also evaluated options BAT-1 and BAT-3 for new sources. For the final iron and steel regulation, EPA established NSPS for by-product cokemaking subcategory based on BAT-1. EPA ultimately rejected BAT-3 for the reasons set forth in Section VIII.A.3.a of the preamble to the final rule. EPA considers BAT-1 as the “best” demonstrated technology for new sources in the by-product segment of the subcategory. EPA concluded that the chosen technology does not present a barrier to entry because 75 percent of existing facilities currently employ the technology. The Agency considered energy requirements and other non-water quality environmental impacts and found no basis for any different standards than the selected NSPS. Therefore, EPA is promulgating NSPS for the by-products recovery cokemaking segment that are identical to BAT for toxic and non-conventional pollutants, while also promulgating TSS, oil and grease (measured as HEM), and pH limitations, using the same technology basis.

Pretreatment Standards for Existing Sources (PSES)

EPA considered four PSES options for indirect discharging by-product recovery cokemaking facilities. The four options rely on physical/chemical or biological treatment or a combination of both to reduce the discharge of pollutants from by-product recovery cokemaking facilities. For PSES, treatment is performed to ensure that pollutants discharged by the industry do not "pass through" POTWs to waters of the United States or interfere with POTW operations or sludge disposal practices. The four technology options are:

- Option 1 (PSES-1): Emission control scrubber blowdown to coke quench stations, oil and tar removal, flow equalization prior to ammonia stripping, free and fixed ammonia stripping, and post ammonia stripping equalization;

- Option 2 (PSES-2): PSES-1 treatment with cyanide precipitation, sludge dewatering, and multimedia filtration;

- Option 3 (PSES-3): Equivalent to BAT-1; and

- Option 4 (PSES-4): Equivalent to BAT-3.

As discussed in the 2000 proposal, EPA dropped PSES-2 and PSES-4 from consideration because PSES-2 is a proprietary technology which would make costs and economic achievability difficult to predict, and PSES-4 achieves pollutant removals equivalent to PSES-3 but was much more costly. Therefore, for the final rule, EPA considered only PSES-1 and PSES-3 as the basis for the by-product segment of the cokemaking subcategory pretreatment standards. Figures 9-3 and 9-4 show PSES-1 and PSES-3 considered for the eight indirect discharging by-product recovery cokemaking facilities. The following discussion explains each option in further detail.

PSES-1 is based on free and fixed ammonia distillation (stripping), or ammonia stills. See the discussion of ammonia stills under BAT above for additional information regarding the design, operation, and effectiveness of these units in removing the cokemaking pollutants of concern. As shown in Table 9-1, seven of the eight indirect discharging sites in this subcategory use free and fixed ammonia distillation systems. One site uses an air stripping unit rather than an ammonia still.

PSES-3 is the same as PSES-1 with the addition of biological treatment with nitrification for increased pollutant removal. PSES-3 is equivalent to BAT-1 for direct discharging facilities. See the previous BAT section for a discussion of this technology.

For the final iron and steel regulation, EPA established PSES limitations for by-product cokemaking subcategory based on PSES-1. EPA rejected PSES-3 because it determined that the option was not economically achievable for indirect dischargers in this segment. EPA concluded that PSES-1 represents the most appropriate basis for pretreatment standards for the following reasons. First, PSES-1, in combination with treatment occurring at the receiving POTWs, will substantially reduce the levels of all cokemaking pollutants of concern. Well-operated free and fixed ammonia stills will remove gross amounts of ammonia-N, cyanide, and some organic pollutants such as the volatile and semi-volatile organic compounds, while the activated sludge biological treatment at the POTWs will remove additional ammonia-N, cyanide, naphthalene, and the other organic constituents of the wastewater to low levels. Second, EPA has considered the compliance costs associated with this option and determined they are economically achievable.

EPA is also establishing a mechanism by which by-product cokemaking facilities discharging to POTWs with nitrification capability would not be subject to the pretreatment standard for ammonia-N. This is because EPA has determined that ammonia-N does not pass through such POTWs. See Section 12 for more information.

Pretreatment Standards for New Sources (PSNS)

The Agency also evaluated options PSES-1 and PSES-3 as the technology basis for indirect discharging new sources. For the final iron and steel regulation, EPA established PSNS limitations for by-product cokemaking subcategory based on PSES-3. This option achieves the greater removals of the two options considered for the final rule. EPA considered the cost of PSES-3 technology for new facilities in this segment. EPA concluded that such costs are not so great as to constitute a barrier to entry, as demonstrated by the fact that three of the eight currently operating indirect discharging facilities are using these technologies. The Agency considered energy requirements and other non-water quality environmental impacts and found no basis for any different standards than the selected PSNS.

EPA is also establishing a mechanism by which by-product cokemaking facilities discharging to POTWs with nitrification capability would not be subject to the pretreatment standard for ammonia-N. This is because EPA has determined that ammonia-N does not pass through such POTWs. See Section 12 for more information.

9.1.2 Non-Recovery Cokemaking

All non-recovery cokemaking sites reported zero discharge of process wastewater in industry survey responses. Because non-recovery cokemaking operations do not discharge any process wastewater, the Agency concludes that non-recovery cokemaking operation itself represents the best practicable technology currently available and that no discharge of process wastewater pollutants is a reasonable BPT limitation. For the same reason, the Agency concludes that there are no costs associated with achieving this limitation, and expects that no additional pollutant removals attributable to this segment will occur. Accordingly, EPA considered zero discharge as the only technology option for non-recovery cokemaking facilities for BPT, BCT, BAT, NSPS, PSES, and PSNS. EPA identified no technologies that can achieve greater removals of toxic, conventional, and nonconventional pollutants than those that are the basis for BPT (i.e., zero discharge).

9.2 Ironmaking and Sintering

In the final rule, EPA is not changing the subcategory structure for the ironmaking and sintering subcategories. However, as explained in Section 1, EPA performed all the analyses on the proposed subcategory structure. Therefore, this section discusses the technology options considered for the proposed ironmaking subcategory, which includes the sintering and blast furnace segments.

Best Practicable Control Technology Currently Available (BPT)

EPA did not consider any revision to the existing BPT limitations for the ironmaking subcategory. For the sintering subcategory, EPA is creating two new segments. The segment, sintering operations with wet air pollution control, is a recodification of what was formerly subcategory-wide limitations. The second segment, sintering operations with dry air pollution control, is new. EPA is establishing BPT limitations for the sintering operations with dry air pollution control segment of the sintering subcategory. These limitations are: no discharge of process wastewater pollutants. See Section 7.1.2 for more information about what constitutes process wastewater for this segment. Because sintering operations with dry air pollution control do not generate any process wastewater, the Agency concludes that sintering operation with dry air pollution control itself represents the best practicable technology currently available and that no discharge of process wastewater pollutants is a reasonable BPT limitation. For the same reason, the Agency concludes that there are no costs associated with achieving this limitation, and expects that no additional pollutant removals attributable to this segment will occur. Accordingly, EPA considered zero discharge as the only technology option for the sintering operations with dry air pollution control segment of the sintering subcategory for BPT, BCT, BAT, NSPS, PSES, and PSNS. EPA identified no technologies that can achieve greater removals of toxic, conventional, and nonconventional pollutants than those that are the basis for BPT (i.e., zero discharge).

Best Conventional Pollutant Control Technology (BCT)

EPA is not revising any existing BCT limitations for ironmaking because there are no technologies that achieve greater removals of conventional pollutants than the technology basis for the current BPT and that pass the BCT cost test.

Best Available Technology Economically Achievable (BAT)

Wastewater from blast furnace ironmaking and sintering operations contain similar pollutants of concern. Sites with both operations typically cotreat wastewater. Therefore, with the exception of cooling towers, which apply to blast furnace operations only, EPA considered the same technology options for both ironmaking and sintering operations for the final rule. The option, BAT-1, relies on improved high-rate recycle and physical/chemical treatment to reduce the discharge of pollutants from blast furnace ironmaking and sintering operations. The technology basis for BAT-1 is solids removal with high-rate recycle and metals precipitation, cooling tower, breakpoint chlorination, and multimedia filtration of blowdown wastewater. Figure 9-5 presents the BAT-1 technology option evaluated by the Agency.

High-rate recycle coupled with recycle treatment, consisting of solids removal via clarification and cooling, are key components of the BAT-1 option because they allow wastewater to be reused, thereby reducing wastewater discharge volumes and pollutant loadings. Common pollutants in blast furnace wastewater removed by the high-rate recycle system treatment components include total suspended solids (TSS), ammonia, cyanides, phenolic compounds, and metals. Wastewater from sintering operations also contains these pollutants, along with oil and grease (O&G) and dioxins and furans. As shown in Table 9-2, all 14 of the blast furnace ironmaking and sintering sites use high-rate recycle with clarification; 11 of 14 use cooling towers.

Metals in wastewater blowdown are further treated by metals precipitation. Metals precipitation removes metallic contaminants from the wastewater by converting soluble, heavy metals to insoluble salts, typically metal hydroxides. The precipitated solids are then removed by sedimentation and filtration. The metal hydroxides are formed through chemical addition of lime, caustic, magnesium hydroxide, or soda ash. As shown in Table 9-2, 9 of the 14 blast furnace ironmaking and sintering sites use blowdown metals precipitation.

Breakpoint chlorination uses sodium hypochlorite or chlorine gas in a carefully controlled pH environment to remove ammonia, although incidental removals of cyanide and phenols will occur. See the BAT-3 discussion for by-product recovery cokemaking in Section 9.1.1 for more information concerning breakpoint chlorination. As shown in Table 9-2, 2 of the 14 blast furnace ironmaking and sintering sites uses breakpoint chlorination.

Finally, multimedia (mixed media) filtration polishes treated effluent and removes dioxins and furans from sintering wastewater. A granular media contained in a bed remove suspended solids from the wastewater. When the pressure drop across the filter, caused by solids accumulation in the bed, is large enough to impede flow, the bed is cleaned by backwashing. Backwashing forces wash water through the bed in the reverse direction of original flow, removing accumulated solids. As shown in Table 9-2, 5 of the 14 blast furnace ironmaking and sintering sites use multimedia filtration.

During four sampling episodes, EPA found several of the dioxin and furan congeners in both the raw and treated wastewater from sinter plants operating wet air pollution control technologies. EPA concludes that multimedia filtration will remove all the dioxin/furan congeners to below the method detection limit. Dioxins and furans are hydrophobic compounds that tend to adhere to solids present in a solution. Multimedia filtration, which is designed to remove solids, will also remove the dioxins/furans adhering to solids as well. EPA has data from two sampling episodes at sinter plants demonstrating that filtration of wastewater samples containing dioxins and furans at treatable levels will reduce their concentrations to nondetectable levels. This is true even for raw wastewater that has undergone no other treatment. Currently none of the sintering sites use multimedia filtration to treat sintering wastewater prior to commingling with any non-sintering and non-blast furnace wastewaters.

Increased high-rate recycle is the major difference between the BAT-1 technology basis and the 1982 technology basis. Representatives from Ispat-Inland Steel commented during EPA/industry meetings subsequent to proposal that using pulverized coal injection (PCI) at Ispat-Inland's No. 7 furnace has led to severe corrosion in the Bischoff scrubber used for gas cleaning. Operators have had to increase the blowdown rate from 43 gpt in 1997 to approximately 70 gpt to control high chloride levels and minimize corrosion.

Based on this comment, EPA evaluated the reported injection rates for pulverized and granulated coal (PCI/GCI) in 1997. All but two sites with furnaces using PCI/GCI reported PNFs at or below 70 gpt in 1997. One of these sites operates a high-rate recycle system that is not optimized for minimal blowdown, and the second site does not have a high-rate recycle system. PNFs below 25 gpt were reported for furnaces at two sites using PCI/GCI.

To obtain additional information to further evaluate the potential impact of PCI/GCI on the achievability of the model PNF, EPA contacted representatives of Ispat-Inland Steel, Bethlehem Steel, and U.S. Steel to review current blast furnace operations and operating practices to minimize corrosion in blast furnace treatment and recycle systems. Contact reports are included in the Iron and Steel Administrative Record (Section 14.1, DCN IS10359). The focus of the review was furnaces using PCI, and the objective was to collect information for use in determining appropriate blowdown rates for blast furnace operations using PCI/GCI.

Site personnel provided detailed descriptions and supporting data demonstrating that corrosion has become a significant issue with using PCI to increase furnace productivity. Site contacts indicated that it is likely that PCI use as a coke substitute will increase the concentrations of chlorides and the potential for corrosion. Furnace operators report that chloride concentrations in the range of 1,500 to 2,000 mg/L are tolerable with increased treatment of the recirculating water with corrosion inhibitors. This range can be maintained with the model PNF of 70 gpt developed for the 1982 rule.

Based on this evaluation, EPA has determined BAT-1 is not the best available technology for existing blast furnace ironmaking operations. EPA is therefore leaving unchanged all BAT limitations currently in effect for the sintering and ironmaking subcategories. However, as proposed, EPA is promulgating a new limitation for 2,3,7,8-tetrachlorodibenzofuran (TCDF) for sintering operations with wet air pollution control systems in the sintering subcategory. The technology basis for the 2,3,7,8-TCDF limitation is multimedia filtration (in addition to the technology basis adopted in the 1982 rule), which was proposed as part of BAT-1.

Survey responses indicate that it is common practice for facilities to combine their sintering wastewater with other iron and steel wastewaters prior to discharge to the receiving water body. This practice dilutes dioxin and furan concentrations to levels below the analytical method detection limit. Because EPA wants to ensure that dioxin and furan congeners are removed from the wastewater and not simply diluted (to ensure that the limitations reflect the actual reductions that can be achieved using the BAT technology), EPA is applying the technology option at a point after commingling with any sintering or blast furnace operation wastewater, but prior to mixing with process wastewaters from processes other than sintering and ironmaking, non-process wastewaters or non-contact cooling water, if such water(s) are in an amount greater than 5 percent by volume of the sintering process wastewaters.

New Source Performance Standards (NSPS)

The Agency also evaluated option BAT-1 for new sources. For the same reasons discussed under BAT, EPA is leaving unchanged NSPS currently in effect for the ironmaking subcategory. EPA is promulgating a new limitation for 2,3,7,8-TCDF for sintering operations with wet air pollution control systems. The technology basis for the 2,3,7,8-TCDF limitation is multimedia filtration (in addition to the technology basis adopted in the 1982 rule). All other new source limitations for sintering operations with wet air pollution control remain unchanged.

Pretreatment Standards for Existing Sources (PSES)

The Agency evaluated only one option, PSES-1, for indirect discharging sites. The PSES-1 option is equivalent to BAT-1, but without breakpoint chlorination and multimedia filtration. Figure 9-6 presents the PSES technology option evaluated by the Agency. For the same reasons discussed under BAT, EPA is leaving unchanged existing pretreatment standards for the ironmaking subcategory, although EPA is establishing a mechanism by which ironmaking facilities discharging to POTWs with nitrification capability would not be subject to the pretreatment standard for ammonia-N. This is because EPA has determined that ammonia-N does not pass through such POTWs.

However, EPA is promulgating a new limitation for 2,3,7,8-TCDF for sintering operations with wet air pollution control systems. The technology basis for the 2,3,7,8-TCDF limitation is multimedia filtration (in addition to the technology basis adopted in the 1982 rule), which was proposed as part of BAT-1. All other existing standards remain unchanged. EPA is also establishing a mechanism by which sintering facilities discharging to POTWs with nitrification capability would not be subject to the pretreatment standard for ammonia-N. This is because EPA has determined that ammonia-N does not pass through such POTWs. However, to EPA's knowledge, there are no existing indirect dischargers of sintering wastewater.

Pretreatment Standards for New Sources (PSNS)

The Agency also evaluated option PSES-1 for new sources. For the same reasons discussed under BAT, EPA is leaving unchanged all PSNS for ironmaking subcategories, except to establishing a mechanism by which ironmaking facilities discharging to POTWs with nitrification capability would not be subject to the pretreatment standard for ammonia-N. This is because EPA has determined that ammonia-N does not pass through such POTWs.

However, as proposed, EPA is promulgating a new limitation for 2,3,7,8-TCDF for sintering operations with wet air pollution control systems. The technology basis for the 2,3,7,8-TCDF limitation is multimedia filtration (in addition to the technology basis adopted in the 1982 rule), which was proposed as part of BAT-1. All other existing standards remain unchanged. EPA is also establishing a mechanism by which sintering facilities discharging to

POTWs with nitrification capability would not be subject to the pretreatment standard for ammonia-N. This is because EPA has determined that ammonia-N does not pass through such POTWs. However, to EPA's knowledge, there are no existing indirect dischargers of sintering wastewater.

9.3 Integrated Steelmaking

Best Practicable Control Technology Currently Available (BPT)

EPA did not consider any revision to the existing BPT limitations for the operations included in the proposed integrated steelmaking subcategory.

Best Conventional Pollutant Control Technology (BCT)

EPA did not consider revising any existing BCT limitations for the operations included in the proposed integrated steelmaking subcategory because there are no technologies that achieve greater removals of conventional pollutants than the technology basis for the current BPT and that pass the BCT cost test.

Best Available Technology Economically Achievable (BAT)

EPA considered one technology option evaluated for this subcategory for treatment of wastewater associated with basic oxygen furnace (BOF) steelmaking, vacuum degassing, and continuous casting operations at direct discharging integrated steelmaking facilities, whether treated individually or cotreated. Industry survey responses indicate that cotreatment is a common practice, but depends largely on the proximity of manufacturing processes. The option relies on both in-process high-rate recycle systems and physical/chemical treatment commonly used in the industry to reduce the discharge of pollutants of concern from BOF, vacuum degassing, and continuous casting operations. The BAT-1 technology option is:

- BAT-1
    - BOF systems: high-rate recycle using a high-volume classifier for primary solids removal, followed by a high-efficiency clarifier for solids removal with sludge dewatering, carbon dioxide injection prior to clarification in wet-open combustion and wet-suppressed combustion BOF recycle systems to remove scale forming ions, and a cooling tower; blowdown treatment by metals precipitation,
    - Vacuum degassing systems: high-rate recycle using a high-efficiency clarifier for solids removal with sludge dewatering, and a cooling tower; blowdown treatment by metals precipitation, and
    - Continuous casting systems: high-rate recycle using a scale pit with oil removal to recover mill scale and remove O&G, a roughing

clarifier for coarse solids removal with sludge dewatering, multimedia filtration for polishing, and a cooling tower; blowdown treatment by metals precipitation.

Blowdown from each of these high-rate recycle systems can be treated in separate metals precipitation systems or cotreated. Figure 9-7 presents the BAT-1 option evaluated by the Agency.

BAT-1 is based on high-rate recycle and associated treatment for solids removal, watering softening, and water cooling prior to reuse; metals in high-rate recycle blowdown are removed by metals precipitation and filtration. High-rate recycle coupled with recycle treatment, consisting of solids removal (via scale pits and clarification) and cooling, are key components of the technology option because they allow wastewater to be reused, thereby reducing wastewater discharge volumes and pollutant loadings. Common pollutants in BOF, vacuum degassing, and continuous casting wastewater removed by the high-rate recycle system treatment components include total suspended solids (TSS), oil and grease (O&G), and metals. As shown in Table 9-3, 20 of the 21 integrated steelmaking facilities use high-rate recycle systems with treatment.

Scale accumulation in wet-open and wet-suppressed BOF recycle systems dictate blowdown rates. Carbon dioxide injection removes scale-forming ions (hardness) from the recycle water, which allows higher recycle rates and less blowdown. Wet-open and wet-suppressed recycle systems also use carbon dioxide injection to control pH. As shown in Table 9-3, 5 of the 21 integrated steelmaking facilities use carbon dioxide injection in BOF high-rate recycle systems.

Metals in wastewater blowdown are further treated by metals precipitation. Metals precipitation removes metallic contaminants from the wastewater by converting soluble, heavy metals to insoluble salts, typically metal hydroxides. The precipitated solids are then removed by sedimentation. The metal hydroxides are formed through chemical addition of lime, caustic, magnesium hydroxide, or soda ash. As shown in Table 9-3, 7 of the 21 integrated steelmaking sites use blowdown metals precipitation.

Finally, multimedia (mixed media) filtration polishes treated effluent. A granular media contained in a bed remove suspended solids from the wastewater. When the pressure drop across the filter, caused by solids accumulation in the bed, is large enough to impede flow, the bed is cleaned by backwashing. Backwashing forces wash water through the bed in the reverse direction of original flow, removing accumulated solids. As shown in Table 9-3, 18 of the 21 integrated steelmaking sites use multimedia filtration.

All sites with ladle metallurgy operations reported zero discharge of process wastewater in industry survey responses. Accordingly, EPA considered zero discharge as the only technology option for ladle metallurgy operations.

EPA is not promulgating effluent limitations and standards because it determined the option was not economically achievable. The proposed option when considered together with options for other subcategories resulted in a significant economic impact that EPA determined is unreasonable. Therefore, EPA is leaving unchanged all BAT limitations currently in effect for operations included in the proposed integrated steelmaking subcategory, with one exception.

EPA is promulgating revised BPT, BAT, BCT, and PSES limitations and standards for one segment of the steelmaking subcategory - basic oxygen furnaces with semi-wet air pollution control. This is consistent with what was appeared in the proposal (65 FR 81980) and the February 14, 2001 Notice (66 FR 10253-54), although rather than establishing a specific limitation, EPA has allowed the permit authority or pretreatment control authority to determine limitations based on best professional judgment, when safety considerations warrant. The Agency believes best professional judgment will allow the permit authority or pretreatment control authority to reflect the site-specific nature of the discharge. EPA is doing this because, although the 1982 regulation requires basic oxygen furnace semi-wet air pollution control to achieve zero discharge of process wastewater pollutants, currently not all of the sites are able to achieve this discharge status because of safety and operational considerations. The Agency recognizes the benefit of using excess water in basic oxygen furnaces with semi-wet air pollution control systems in cases where safety considerations are present. The Agency justifies the increased allowance in this case because of the employee safety and manufacturing considerations (reduced production equipment damage and lost production). EPA estimates that the industry will incur no costs due to this change. EPA could identify no potential adverse environmental impacts associated with the potential discharge.

New Source Performance Standards (NSPS)

The Agency also evaluated option BAT-1 for BOF steelmaking, vacuum degassing, and continuous casting operations, and zero discharge for ladle metallurgy operations, in the integrated steelmaking subcategory. EPA is not promulgating effluent limitations and standards based on this technology because, when considered together with options for other subcategories, EPA determined that it would result in an unacceptable economic impact. Except as noted below, EPA is leaving unchanged all NSPS currently in effect for operations included in the proposed integrated steelmaking subcategory.

In the case of electric arc furnaces with semi-wet air pollution control, the Agency is promulgating NSPS, PSES, and PSNS limitations and standards of zero discharge of process wastewater pollutants. The 1982 regulation previously established BPT, BCT, and BAT limitations of zero discharge of process wastewater pollutants for electric arc furnaces with semi-wet air pollution control. EPA identified no discharges from electric arc furnaces with semi-wet air pollution control and received no comments regarding the establishment of zero discharge of process wastewater pollutants for this segment. EPA estimates that the industry will incur no costs due to this change since all known facilities are currently achieving compliance with zero discharge of process wastewater pollutants.

Pretreatment Standards for Existing Sources (PSES)

EPA considered one technology option for this subcategory for treatment of wastewater associated with BOF steelmaking, vacuum degassing, and continuous casting operations at indirect discharging integrated steelmaking facilities. This option, PSES-1, is equivalent to BAT-1 and relies on both in-process high-rate recycle systems and physical/chemical treatment commonly used in the industry to reduce the discharge of pollutants of concern from BOF, vacuum degassing, and continuous casting operations. Figure 9-7 presents the PSES technology option evaluated by the Agency.

In addition, all sites with ladle metallurgy operations reported zero discharge of process wastewater in industry survey responses. Accordingly, EPA considered zero discharge as the only technology option for ladle metallurgy operations.

EPA is not promulgating effluent limitations and standards based on this technology because it determined that it was not economically achievable. The proposed option when considered together with options for other subcategories resulted in a significant economic impact that EPA determined is unreasonable. Therefore, EPA is leaving unchanged all PSES limitations currently in effect for operations under the proposed integrated steelmaking subcategory, except for steelmaking subcategory-basic oxygen furnaces with semi-wet air pollution control, which is described above under BAT and electric arc furnaces with semi-wet air pollution control, which is described under NSPS.

Pretreatment Standards for New Sources (PSNS)

The Agency also evaluated option PSES-1 for BOF steelmaking, vacuum degassing, and continuous casting operations, and zero discharge for ladle metallurgy operations, in the integrated steelmaking subcategory. EPA is not promulgating effluent limitations and standards based on this technology because, when considered together with options for other subcategories, EPA determined that it would result in an unacceptable economic impact. Therefore, EPA is leaving unchanged all PSNS currently in effect for operations included in the proposed integrated steelmaking subcategory, except for electric arc furnaces with semi-wet air pollution control, which is described under NSPS.

9.4 Integrated and Stand-Alone Hot Forming

Best Practicable Control Technology Currently Available (BPT)

EPA did not consider revising any existing BPT limitations for operations included in the proposed integrated and stand-alone hot forming subcategory.

Best Conventional Pollutant Control Technology (BCT)

EPA is not revising any existing BCT limitations for operations included in the proposed integrated and stand-alone hot forming subcategory because it did not identify any technologies that achieve greater removals of conventional pollutants than the technology basis for the current BPT and that pass the BCT cost test.

Best Available Technology Economically Achievable (BAT)

EPA evaluated equivalent technology options for each segment of this subcategory: carbon and alloy steel and stainless steel. The option relies on both in-process high-rate recycle systems and physical/chemical treatment commonly used in the industry to reduce the discharge of pollutants of concern from hot forming operations. The BAT-1 technology includes high-rate recycle using a scale pit with oil skimming, a roughing clarifier with oil skimming, sludge dewatering, a multimedia filter for polishing, and a cooling tower to lower the water temperature to acceptable levels to reuse and treatment of blowdown with multimedia filtration. For both segments, high-rate recycle and treatment of wastewater from contact water systems used for scale removal, roll cooling, product cooling, flume flushing, and other miscellaneous sources (e.g., roll shops, basement sumps) is common. Figure 9-8 presents the BAT technology option evaluated by the Agency.

BAT-1 is based on high-rate recycle and associated treatment for solids removal, and water cooling prior to reuse. High-rate recycle coupled with recycle treatment, consisting of solids removal (via scale pits, clarification, and filtration) and cooling, are key components of the technology option because they allow wastewater to be reused, thereby reducing wastewater discharge volumes and pollutant loadings. Common pollutants in hot forming wastewater removed by the high-rate recycle system treatment components include total suspended solids (TSS) and oil and grease (O&G). As shown in Table 9-4, 25 of the 32 direct discharging facilities in this subcategory use high-rate recycle systems with treatment.

Multimedia (mixed media) filtration removes solids not removed by scale pits and clarification. A granular media contained in a bed removes suspended solids from the wastewater. When the pressure drop across the filter, caused by solids accumulation in the bed, is large enough to impede flow, the bed is cleaned by backwashing. Backwashing forces wash water through the bed in the reverse direction of original fluid flow, removing accumulated solids. As shown in Table 9-4, 9 of the 32 direct discharging facilities in this subcategory use multimedia filtration.

EPA is not adopting limits and standards based on this technology because it determined that it was not economically achievable. EPA has determined that the impact is unacceptable in view of the precarious financial situation of the proposed subcategory as a whole. Moreover, many facilities are already at or below discharge levels of the proposed effluent limitations guidelines and standards, and EPA has no reason to believe that facilities will reverse this trend and increase pollutant discharges above the 1997 levels in EPA’s record database.

New Source Performance Standards (NSPS)

The Agency also evaluated option BAT-1 for new sources. However, EPA is not promulgating NSPS based on this technology option, because EPA has determined that the economic impact of this option is unacceptable in view of the precarious financial strength of the affected facilities. Therefore, EPA is leaving unchanged all NSPS currently in effect for operations included in the proposed integrated and stand-alone hot forming subcategory.

Pretreatment Standards for Existing Sources (PSES)

EPA proposed not to revise the current PSES for each segment. At proposal, EPA considered identical technology options for each segment of this subcategory: carbon and alloy steel and stainless steel. The option, PSES-1, is equivalent to BAT-1 and relies on both in-process high-rate recycle systems and physical/chemical treatment commonly used in the industry to reduce the discharge of pollutants of concern from hot forming operations. Figure 9-8 presents the PSES technology option evaluated by the Agency. Table 9-4 shows that three of the five indirect discharging facilities in this subcategory use high-rate recycle systems with treatment.

Consistent with its position at proposal, EPA is not revising PSES limitations for the integrated and stand-alone hot forming subcategory based on this technology option. EPA's reasons are set forth in the preamble to the proposed rule. Therefore, EPA is leaving unchanged all PSES limitations currently in effect for operations that would have been covered in the proposed integrated and stand-alone hot forming subcategory.

Pretreatment Standards for New Sources (PSNS)

The Agency also evaluated option PSES-1 for new sources. However, EPA is not promulgating PSNS based on this technology option for the reasons described above for PSES. Therefore, EPA is leaving unchanged all PSNS currently in effect for operations included in the proposed integrated and stand-alone hot forming subcategory.

9.5 Non-Integrated Steelmaking and Hot Forming

Best Practicable Control Technology Currently Available (BPT)

EPA did not consider any revision to the existing BPT limitations for the non-integrated steelmaking and hot forming subcategory.

Best Conventional Pollutant Control Technology (BCT)

EPA is not revising any existing BCT limitations for operations included in the proposed non-integrated steelmaking and hot forming subcategory because there are no technologies that achieve greater removals of conventional pollutants than the technology basis for the current BPT and that pass the BCT cost test.

Best Available Technology Economically Achievable (BAT)

EPA evaluated one technology option for treatment of wastewater associated with vacuum degassing, continuous casting, and hot forming operations at non-integrated steelmaking and hot forming facilities, whether treated individually or cotreated. Industry survey responses indicate that cotreatment is a common practice at non-integrated mills. The BAT-1 technology option relies on both in-process high-rate recycle systems and physical/chemical treatment to reduce the discharge of pollutants of concern from vacuum degassing, continuous casting, and hot forming operations, and applies to both industry segments: carbon and alloy steel and stainless steel. The BAT-1 technology option is:

- BAT-1
  - Continuous casting systems: high-rate recycle using a scale pit with oil removal to recover mill scale and remove O&G, a roughing clarifier for coarse solids removal with sludge dewatering, multimedia filtration for polishing, and a cooling tower,
  - Vacuum degassing systems: wastewater cotreated in the continuous casting system, roughing clarifier with sludge dewatering, and a cooling tower,
  - Hot forming systems: high-rate recycle using a scale pit with oil removal to recover mill scale and remove O&G, a roughing clarifier for coarse solids removal with sludge dewatering, multimedia filtration for polishing, and a cooling tower, and
  - Combined thin slab casting/hot forming systems: high-rate recycle using a scale pit with oil removal to recover mill scale and remove O&G, a roughing clarifier for coarse solids removal with sludge dewatering, multimedia filtration for polishing, and a cooling tower.

For both segments, high-rate recycle and treatment of wastewater from vacuum degassing, continuous casting, and hot forming operations at non-integrated facilities are common. Figure 9-9 shows the BAT option evaluated by the Agency for non-integrated steelmaking and hot forming sites. This figure applies for both segments.

The Agency realizes that many sites may be configured such that the combined treatment of operations may not be possible. In such cases, separate treatment equipment for manufacturing processes, as required, equivalent to the combined treatment system would achieve model treatment system effluent quality. EPA considered these variables when costing sites for treatment systems, as discussed in Section 10.

BAT-1 is based on high-rate recycle and associated treatment for solids removal and water cooling prior to reuse. High-rate recycle coupled with recycle treatment, consisting of solids removal (via scale pits, clarification, and filtration) and cooling, are key components of the technology option because they allow wastewater to be reused, thereby reducing wastewater discharge volumes and pollutant loadings. Common pollutants in vacuum degassing, continuous casting, and hot forming wastewater removed by the high-rate recycle system treatment components include TSS and O&G. As shown in Table 9-5, 30 of the 35 direct discharging facilities in this subcategory use high-rate recycle systems with treatment.

Multimedia (mixed media) filtration removes solids not removed by scale pits and clarification. A granular media contained in a bed removes suspended solids from the wastewater. When the pressure drop across the filter, caused by solids accumulation in the bed, is large enough to impede flow, the bed is cleaned by backwashing. Backwashing forces wash water through the bed in the reverse direction of original fluid flow, removing accumulated solids. As shown in Table 9-5, 25 of the 35 direct discharging facilities in this subcategory use multimedia filtration.

All sites with electric arc furnaces (EAFs) and ladle metallurgy stations reported zero discharge of process wastewater in industry survey responses. Accordingly, EPA used zero discharge as the only technology option for EAF and ladle metallurgy operations.

However, EPA is not promulgating BAT limitations for non-integrated steelmaking and hot forming subcategory based on these technology options. Judging from the installation costs and the pollutant reductions associated with these treatment technologies, EPA concluded that the technology simply was not the best available to achieve pollutant removals (EPA estimated that the technology could remove approximately 230 pound-equivalents (lb-eq) per year at an estimated cost of $2,069 per lb-eq for direct discharging stainless segment, and 3,891 pound-equivalents per year at an estimated cost of $941 per lb-eq in the direct discharging carbon and alloy segment). Therefore, EPA is leaving unchanged all BAT limitations currently in effect for operations included in the proposed non-integrated steelmaking and hot forming subcategory.

New Source Performance Standards (NSPS)

EPA evaluated BAT-1 for vacuum degassing, continuous casting, and hot forming operations, and zero discharge for EAFs and ladle metallurgy, for new sources. The Agency also evaluated a second technology option based on zero discharge for all non-integrated steelmaking and hot forming operations. EPA selected the zero discharge option as the basis of the proposed NSPS for this subcategory.

Based on additional information provided in comments received on the proposed rule, EPA determined that it is not always possible, or even desirable, for non-integrated steelmaking and hot forming sites to operate their manufacturing processes to achieve zero discharge. The Agency has identified technical barriers to achieving zero discharge via evaporative uses such as electrode spray cooling and slag quenching, particularly for hot forming wastewater.

EPA is leaving unchanged all NSPS currently in effect for operations included in the proposed non-integrated steelmaking and hot forming subcategory, with the exception of electric arc furnaces with semi-wet air pollution control. For those operations, the Agency is promulgating NSPS standards of zero discharge of process wastewater pollutants. EPA identified no discharges from electric arc furnaces with semi-wet air pollution control and received no comments regarding the establishment of zero discharge of process wastewater pollutants for this segment. EPA estimates that the industry will incur no costs due to this change since all known facilities are currently achieving compliance with zero discharge of process wastewater pollutants.

Pretreatment Standards for Existing Sources (PSES)

EPA considered one technology option for this subcategory for treatment of wastewater associated with vacuum degassing, continuous casting, and hot forming operations at indirect discharging non-integrated steelmaking and hot forming facilities. This option, PSES-1, is equivalent to BAT-1 and relies on both in-process high-rate recycle systems and physical/chemical treatment to reduce the discharge of pollutants of concern from vacuum degassing, continuous casting, and hot forming operations. Figure 9-9 presents the PSES technology option evaluated by the Agency. Table 9-5 shows that 10 of the 11 indirect discharging facilities in this subcategory use high-rate recycle systems with treatment; 3 of the 6 use multimedia filtration for polishing. Two sites also discharge both directly and indirectly; both use high-rate recycle systems with treatment and multimedia filtration.

In addition, all sites with EAFs and ladle metallurgy stations reported zero discharge of process wastewater in industry survey responses. Accordingly, EPA used zero discharge as the only technology option for EAF and ladle metallurgy operations.

EPA did not propose and is not promulgating PSES limitations for the non-integrated steelmaking and hot forming subcategory–carbon and alloy segment. EPA is not promulgating PSES for the non-integrated steelmaking and hot forming subcategory–stainless segment based on these technology options. Judging from the installation costs and the pollutant reductions associated with the treatment technologies, EPA concluded that the technology simply was not the best available to achieve pollutant removals (EPA estimated that the technology could remove approximately 78 pound-equivalents per year at an estimated cost of $1,970 per lb-eq for the indirect discharging stainless segment). Therefore, EPA is leaving unchanged all PSES currently in effect for operations included in the proposed non-integrated steelmaking and hot forming subcategory, except as described below.

In the case of electric arc furnaces with semi-wet air pollution control, the Agency is promulgating PSES and PSNS of zero discharge of process wastewater pollutants. The 1982 regulation previously established BPT, BCT, and BAT limitations of zero discharge of process wastewater pollutants for electric arc furnaces with semi-wet air pollution control. (EPA is modifying the BPT, BAT, and BCT portions of this segment only to eliminate references in the title to basic oxygen furnace steelmaking-semi-wet.) EPA identified no discharges from electric arc furnaces with semi-wet air pollution control and received no comments regarding the establishment of zero discharge of process wastewater pollutants for this segment. EPA estimates that the industry will incur no costs due to this change since all known facilities are currently achieving compliance with zero discharge of process wastewater pollutants.

Pretreatment Standards for New Sources (PSNS)

EPA evaluated PSES-1 for vacuum degassing, continuous casting, and hot forming operations, and zero discharge for EAFs and ladle metallurgy, for new sources. The Agency also evaluated a second technology option based on zero discharge for all non-integrated steelmaking and hot forming operations. EPA selected the zero discharge option as the basis of the proposed PSNS for this subcategory.

Based on additional information provided in comments received on the proposed rule, EPA determined that it is not always possible, or even desirable, for non-integrated steelmaking and hot forming sites to operate their manufacturing processes to achieve zero discharge. The Agency has identified technical barriers to achieving zero discharge via evaporative uses such as electrode spray cooling and slag quenching, particularly for hot forming wastewater.

EPA is leaving unchanged all PSNS currently in effect for operations included in the proposed non-integrated steelmaking and hot forming subcategory, except in the case of electric arc furnaces with semi-wet air pollution control, which is described above under PSES.

9.6 Steel Finishing

Best Practicable Control Technology Currently Available (BPT)

EPA did not consider any revision to the existing BPT limitations for operations included in the proposed steel finishing subcategory.

Best Conventional Pollutant Control Technology (BCT)

EPA is not revising any existing BCT limitations for the operations included in the proposed steel finishing subcategory because there are no technologies that achieve greater removals of conventional pollutants than the technology basis for the current BPT and that pass the BCT cost test.

Best Available Technology Economically Achievable (BAT)

EPA evaluated separate technology options for this subcategory for the two segments: carbon and alloy steel and stainless steel. The carbon and alloy steel segment technology options control pollutant discharges for wastewater from acid pickling (typically with hydrochloric or sulfuric acids) and associated annealing, cold forming, alkaline cleaning, hot coating, and electroplating operations. The stainless steel segment technology options control pollutant discharges for wastewater from salt bath and electrolytic sodium sulfate (ESS) descaling, acid pickling (typically with sulfuric, nitric, and nitric/hydrofluoric acids), annealing operations, cold forming, and alkaline cleaning.

For both segments, EPA's technology options include both in-process technologies and end-of-pipe wastewater treatment. BAT-1 in-process technologies include countercurrent rinsing, recycle of fume scrubber water, and reuse of acid (acid regeneration, purification, recycle, or recovery) for flow reduction. Flow reduction via countercurrent rinsing and recycle of fume scrubber are key in-process components of the technology option because they minimize water use, thereby reducing wastewater discharge volumes and pollutant loadings. BAT-1 end-of-pipe treatment includes oil removal for segregated oily wastes, flow equalization, hexavalent chromium reduction of hexavalent-chromium-bearing streams, metals precipitation for all waste streams, gravity clarification, and sludge dewatering. As shown in Table 9-6, 14 of the 56 direct discharging facilities in this subcategory use countercurrent rinsing; 33 recycle fume scrubber water; and 55 use metals precipitation. Figures 9-10 and 9-11 show the BAT technology options for the carbon and alloy steel and stainless steel segments, respectively; the technology options for both segments are identical.

The stainless steel segment includes both countercurrent rinsing and recycle of fume scrubber water for flow reduction, with an additional technology, acid purification. Acid purification uses an anion exchange resin to remove acid from metal ions in spent pickle liquor. The acid is desorbed with water and recycled to the process bath. This reduces wastewater discharge volumes and pollutant loadings. As shown in Table 9-6, 7 of the 56 direct discharging facilities in this subcategory use acid purification.

Common pollutants in steel finishing wastewater include TSS, O&G, and metals. Oil removal, hexavalent chromium reduction (when present), and metals precipitation are key end-of-pipe treatment components of the technology option because they remove these pollutants. Oily waste streams should be segregated and pretreated prior to commingling with other steel finishing wastewater. Many steel facilities use oil/water separators (for nonemulsified oils) or chemical emulsion breaking (for emulsified oils) to remove oil. As shown in Table 9-6, 26 of the 56 direct discharging steel finishing facilities use oil removal.

Hexavalent chromium-bearing wastewater streams should also be segregated and pretreated. Hexavalent chromium reduction is a chemical process (using sulfur dioxide, sodium bisulfite, sodium metabisulfite, or ferrous sulfate) where the chromium is reduced to the trivalent form. Once in this form, chromium can be effectively removed by metals precipitation. As shown in Table 9-6, 23 of the 56 direct discharging steel finishing facilities use hexavalent chromium reduction.

Metals in wastewater are treated by metals precipitation. Metals precipitation removes metallic contaminants from the wastewater by converting soluble, heavy metals to insoluble salts, typically metal hydroxides. The precipitated solids are then removed by sedimentation. The metal hydroxides are formed through chemical addition of lime, caustic, magnesium hydroxide, or soda ash. As shown in Table 9-6, 55 of the 56 direct discharging steel finishing facilities use metals precipitation.

Subsequent to the proposed rule, EPA comprehensively reviewed the analyses performed to determine the model flow rates and long-term average pollutant concentrations (LTAs). Sections 13 and 14 describe EPA's revised analyses, with additional documentation provided in the final rulemaking record. As part of this reanalysis for the steel finishing subcategory, and in response to comments on the proposed regulation, EPA conducted additional site visits to three steel finishing facilities for three purposes:

- To assess how rinse water flow rates for steel finishing operations were selected by the sites and how these relate to product quality considerations;

- To determine typical flow control equipment and necessary monitoring practices to operate finishing lines efficiently and obtain relevant cost data; and

- To identify modifications to the finishing lines required to achieve the effluent limitations considered by EPA for the final rule.

EPA's subsequent analyses for steel finishing concluded that the model flow rates were not technically achievable for all facilities.

Therefore, EPA is not promulgating BAT limitations based on these technology options because the flow reductions that were an integral part of the technology interfered with product quality, thus indicating that the technology was not the best available for steel finishing operations. Moreover, after considering comments objecting to EPA's methodology at proposal of estimating costs, EPA performed a new cost analysis. Judging from the retrofit costs and the costs associated with necessary production shutdown during installation of new treatment technologies, EPA concluded that the technology simply was not the best available to achieve pollutant removals.

EPA did not promulgate limitations for the stainless finishing subcategory for the same reasons listed for the carbon and alloy finishing segment, with one additional reason. Commenters with experience operating acid purification units stated that they experienced neither the level of pollutant removal nor the cost savings EPA had envisioned in the analysis supporting the proposal. The recognition of this fact had an adverse impact both on the effluent reduction benefit and the projected cost of this technology option. Therefore, EPA is leaving unchanged all BAT limitations currently in effect for operations included in the proposed steel finishing subcategory.

New Source Performance Standards (NSPS)

The Agency also evaluated option BAT-1 for new sources for both industry segments. However, EPA is not promulgating NSPS based on these technology options for the same reasons discussed under BAT. Therefore, EPA is leaving unchanged all NSPS limitations currently in effect for operations included in the proposed steel finishing subcategory.

Pretreatment Standards for Existing Sources (PSES)

EPA evaluated technology options separately for this subcategory for the two segments: carbon and alloy steel and stainless steel. For both segments, EPA's technology options include both in-process technologies and end-of-pipe wastewater treatment. For each segment, PSES-1 is identical to BAT-1 for the segment. Figures 9-10 and 9-11 show the PSES technology options for the carbon and alloy steel and stainless steel segments, respectively. As presented in the figures, the technology options for both segments are identical.

The PSES-1 in-process technologies include countercurrent rinsing, recycle of fume scrubber water, and reuse of acid (acid regeneration, purification, recycle, or recovery) for flow reduction. As shown in Table 9-6, 10 of the 32 indirect discharging steel finishing facilities use countercurrent rinsing; 14 recycle fume scrubber water; and 5 use acid purification. PSES-1 end-of-pipe treatment includes oil removal for segregated oily wastes, flow equalization, hexavalent chromium reduction of hexavalent-chromium-bearing streams, metals precipitation for all waste streams, gravity clarification, and sludge dewatering. As shown in Table 9-6, 9 of the 32 indirect discharging steel finishing facilities use oil removal; 5 use hexavalent chromium reduction; and 20 use metals precipitation.

However, EPA is not promulgating PSES based on these technology options for the same reasons discusses under BAT. Therefore, EPA is leaving unchanged all PSES limitations currently in effect for operations included in the proposed steel finishing subcategory.

Pretreatment Standards for New Sources (PSNS)

The Agency also evaluated option PSES-1 for new sources for both industry segments. However, EPA is not promulgating PSNS based on these technology options for the same reasons discussed under BAT. Therefore, EPA is leaving unchanged all PSNS limitations currently in effect for operations included in the proposed steel finishing subcategory.

9.7 Other Operations

The other operations subcategory is comprised of three segments: briquetting, direct-reduced ironmaking (DRI), and forging. EPA evaluated BPT options for these operations because the Agency is considering limits for the first time for these segments.

9.7.1 Briquetting

Best Practicable Control Technology Currently Available (BPT)

The four existing briquetting sites in the United States reported zero discharge of process wastewater in industry survey responses. Accordingly, EPA used zero discharge based on dry air pollution controls as the only technology option considered for briquetting operations for BPT, BCT, BAT, NSPS, PSES, and PSNS. EPA identified no technologies that can achieve greater removals of toxic, conventional, and nonconventional pollutants than those that are the basis for BPT (i.e., zero discharge). EPA established these limitations because briquetting operations do not generate any process wastewater. For this reason, the Agency concludes that there are no costs associated with these limitations and standards. Furthermore, EPA projects no additional pollutant removals attributable to this segment.

9.7.2 Direct-Reduced Ironmaking (DRI)

Best Practicable Control Technology Currently Available (BPT)

The BPT technology option includes high-rate recycle with solids removal using a classifier and clarifier, cooling, sludge dewatering, and treatment of blowdown with multimedia filtration. Figure 9-12 shows the BPT technology option for DRI.

High-rate recycle coupled with recycle treatment (consisting of solids removal using a classifier and clarifier) and cooling, are key components of the technology option because they allow wastewater to be reused, thereby reducing wastewater discharge volumes and pollutant loadings. Common pollutants in DRI wastewater removed by the high-rate recycle system treatment components include TSS and metals.

Suspended solids in wastewater blowdown are removed by multimedia (mixed media) filtration prior to discharge. A granular media contained in a bed removes suspended solids from the wastewater. When the pressure drop across the filter, caused by solids accumulation in the bed, is large enough to impede flow, the bed is cleaned by backwashing. Backwashing forces wash water through the bed in the reverse direction of original fluid flow, removing accumulated solids. The DRI site operating in 1997 reported using high-rate recycle technology for wastewater generated from DRI WAPC, and using multimedia filtration for blowdown treatment, as shown in Table 9-7.

The Agency has determined that this treatment system represents the best practicable technology currently available and should be the basis for the BPT limitation for the following reasons. First, this technology option is one that is readily applicable to all facilities in this segment. Second, the adoption of this level of control would represent a significant reduction in pollutants discharged into the environment by facilities in this subcategory (EPA is not able to disclose the estimated amount of pollutant reduction because data aggregation and other masking techniques are insufficient to protect information claimed as confidential business information.) Third, the Agency assessed the total cost of water pollution controls likely to be incurred for this option in relation to the effluent reduction benefits and has determined these costs were reasonable.

EPA did not find significant levels of priority or nonconventional pollutants in DRI wastewater; therefore, EPA did not consider options for BAT. For NSPS, the same technology basis as BPT technology was considered. EPA did not identify any technically feasible options that provide greater environmental protection. In addition, EPA concluded these technology options do not present a barrier to entry because all facilities currently employ the technologies. The Agency considered energy requirements and other non-water quality environmental impacts and found no basis for any different standards than the selected NSPS. Therefore, EPA is adopting NSPS limitations for the DRI segment of the other operations subcategory based on the same technology selected as the basis for BPT for this segment.

EPA identified only conventional pollutants in forging wastewaters at treatable levels. These pollutants do not pass through when discharged to POTWs from facilities within this subcategory.

9.7.3 Forging

Best Practicable Control Technology Currently Available (BPT)

The BPT technology for forging operations consists of high-rate recycle, oil/water separation, and treatment of blowdown with multimedia filtration multimedia filtration. Figure 9-13 shows the BPT technology option for forging.

High-rate recycle coupled with oil removal are key components of the technology option because they allow wastewater to be reused, thereby reducing wastewater discharge volumes and pollutant loadings. O&G is the most common pollutant in forging wastewater. As shown in Table 9-7, four of five forging sites use oil removal equipment.

Suspended solids in wastewater blowdown are removed by multimedia (mixed media) filtration prior to discharge. A granular media contained in a bed remove suspended solids from the wastewater. When the pressure drop across the filter, caused by solids accumulation in the bed, is large enough to impede flow, the bed is cleaned by backwashing. Backwashing forces wash water through the bed in the reverse direction of original fluid flow, removing accumulated solids. As shown in Table 9-7, one of the five forging sites uses multimedia filtration.

The Agency has concluded that this treatment system represents the best practicable technology currently available and should be the basis for the BPT limitation for the following reasons. First, this technology option is one that is readily applicable to all facilities in this segment. Second, the Agency assessed the total cost of water pollution controls likely to be incurred for this option in relation to the effluent reduction benefits (pollutant removals of approximately 3,500 pounds) and determined these costs were reasonable.

EPA did not find significant levels of priority or nonconventional pollutants in forging wastewater; therefore, EPA did not consider options for BAT. For NSPS, the same technology basis as BPT technology was considered. EPA did not identify any technically feasible options that provide greater environmental protection. In addition, EPA concluded these technology options do not present a barrier to entry because all facilities currently employ the technologies. The Agency considered energy requirements and other non-water quality environmental impacts and found no basis for any different standards than the selected NSPS. Therefore, EPA is adopting NSPS limitations for the forging segment of the Other Operations subcategory based on the same technology selected as the basis for BPT for this segment.

EPA identified only conventional pollutants in forging wastewaters at treatable levels. These pollutants do not pass through when discharged to POTWs from facilities within this subcategory. Therefore, EPA is not promulgating pretreatment standards for this segment.

Table 9-1

Wastewater Treatment Technologies Reported by Industry Survey Respondents for By-Product Recovery Cokemaking Sites

Treatment Technology	Number of By-Products Recovery Cokemaking Surveyed Sites Using the Technology	
	Direct Discharge (13 total sites)	**Indirect Discharge (8 total sites)**
Tar/oil removal	12	3
Flow equalization before ammonia still	11	4
Free and fixed ammonia still (a)	12	7
Cooling	10	2
Cyanide precipitation	1	2
Breakpoint chlorination (b)	0	0
Flow equalization before biological treatment or after ammonia still	12	5
Biological treatment by conventional activated sludge	10	2
Biological treatment by biological filtration	2	0
Biological treatment by sequential batch reactors	0	1
Multimedia or sand filtration	4	1
Carbon adsorption	4	0
Sludge dewatering	11	2

(a) One indirect discharger operates an air stripping unit instead of an ammonia still.
(b) Although this technology is not practiced by industry survey respondents, the Agency is aware of one site in North America that practices breakpoint chlorination.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Table 9-2

High-Rate Recycle and Blowdown Treatment Technologies Reported by Industry Survey Respondents for Blast Furnace Ironmaking and Sintering Sites

Treatment Technology	Number of Blast Furnace Ironmaking and Sintering Surveyed Sites Using the Technology (14 total sites) (a)
High-Rate Recycle	
Clarifier	14
Cooling tower	11
Sludge dewatering	12
Blowdown Treatment	
Metals precipitation	9
Breakpoint chlorination	2
Multimedia filtration (b)	5
Granular activated carbon	1

(a) Includes three sites that cotreat blast furnace and sintering wastewater and one site that treats sintering wastewater only.
(b) Multimedia filtration of recycled flow or low-volume blowdown flow.
Note: Summary includes direct and indirect dischargers.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Table 9-3

High-Rate Recycle and Blowdown Treatment Technologies Reported by Industry Survey Respondents for Integrated Steelmaking Sites

Treatment Technology	Number of Integrated Steelmaking Surveyed Sites Using the Technology (21 total sites) (a)
High-Rate Recycle	
Classifier (b)	12
Scale pit (c)	20
CO_2 injection	5
Clarifier	19
Cooling tower (d)	19
Sludge dewatering	13
Blowdown Treatment	
Metals precipitation	7
Multimedia filtration (e)	18

(a) One site is a non-integrated mill with a BOF.
(b) Classifier used for BOF wastewater only except for one site that uses for continuous casting wastewater.
(c) Scale pit for continuous caster wastewater only.
(d) Cooling tower used for vacuum degassing and continuous caster wastewater.
(e) Multimedia filtration of recycled flow or low-volume blowdown flow.
Note: Summary includes direct and indirect dischargers and excludes zero discharge treatment systems.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Table 9-4

High-Rate Recycle and Blowdown Treatment Technologies Reported by Industry Survey Respondents for Integrated and Stand-Alone Hot Forming Sites

Treatment Technology	Number of Integrated and Stand-Alone Hot Forming Surveyed Sites Using the Technology	
	Direct Discharge (32 total sites)	**Indirect Discharge (5 total sites)**
High-Rate Recycle		
Scale pit	25	2
Clarifier	17	3
Sludge dewatering	11	0
Cooling tower	20	3
Blowdown Treatment		
Metals precipitation	2	0
Multimedia filtration (a)	9	0
Once-Through Treatment (b)		
Scale pit	8	1
Clarifier	0	0
Sludge dewatering	0	0
Multimedia filtration	0	0

(a) Multimedia filtration of recycled flow or low-volume blowdown flow.
(b) Once-through treatment applies to eight sites.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Table 9-5

High-Rate Recycle and Blowdown Treatment Technologies Reported by Industry Survey Respondents for Non-Integrated Steelmaking and Hot Forming Sites

Treatment Technology	Number of Non-Integrated Steelmaking and Hot Forming Surveyed Sites Using the Technology		
	Direct Discharge (35 total sites)	Indirect Discharge (11 total sites)	Direct & Indirect Discharge (2 sites)
High-Rate Recycle			
Scale Pit with oil skimming	30	10	2
Clarifier	18	2	2
Cooling tower (a)	25	8	2
Blowdown Treatment			
Metals precipitation	8	1	1
Multimedia filtration (b)	25	3	2
Once-Through Treatment (c)			
Scale pit	2	0	0
Clarifier	1	0	0
Cooling Tower	1	0	0

(a) Cooling tower used for vacuum degassing and/or continuous casting wastewater.
(b) Multimedia filtration of recycled flow or low-volume blowdown flow.
(c) Once-through treatment only applies to two sites, both direct dischargers.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Table 9-6

In-Process and End-of-Pipe Wastewater Treatment Technologies Reported by Industry Survey Respondents for Steel Finishing Sites

Treatment Technology	Number of Steel Finishing Sites Surveyed Using the Technology	
	Direct Discharge (56 total sites)	**Indirect Discharge (32 total sites)**
In-Process Treatment		
Countercurrent rinsing	14	10
Recycle of fume scrubber water	33	14
Acid purification and recycle (a)	7	5
End-of-Pipe Treatment		
Oil removal (b)	26	9
Flow equalization	34	19
Hexavalent chromium reduction (c)	23	5
Metals precipitation	55	20
Gravity sedimentation/clarification	55	17
Sludge dewatering	52	18

(a) Applies to sites with sulfuric acid and nitric/hydrofluoric acid baths for stainless products.
(b) Oil removal technologies in place were primarily oil water separators and oil skimming; however, one site used ultrafiltration.
(c) Applies to sites with hexavalent-chromium-bearing wastewater.
Note: 47 sites reported using fume scrubbers.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Table 9-7

High-Rate Recycle Equipment and Blowdown Wastewater Treatment Technologies Reported by Industry Survey Respondents for Direct-Reduced Ironmaking (DRI) and Forging Sites

Treatment Technology	Number of Sites Surveyed Using the Technology
DRI	(1 site)
High-Rate Recycle	
Classifier and clarifier	1
Cooling Tower	1
Blowdown Treatment	
Multimedia Filtration	1
Forging	(5 sites)
Oil Removal (a)	4
Multimedia Filtration	1

(a) Oil removal may be used as high-rate recycle or blowdown treatment.
Note: Summary includes direct and indirect dischargers.

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

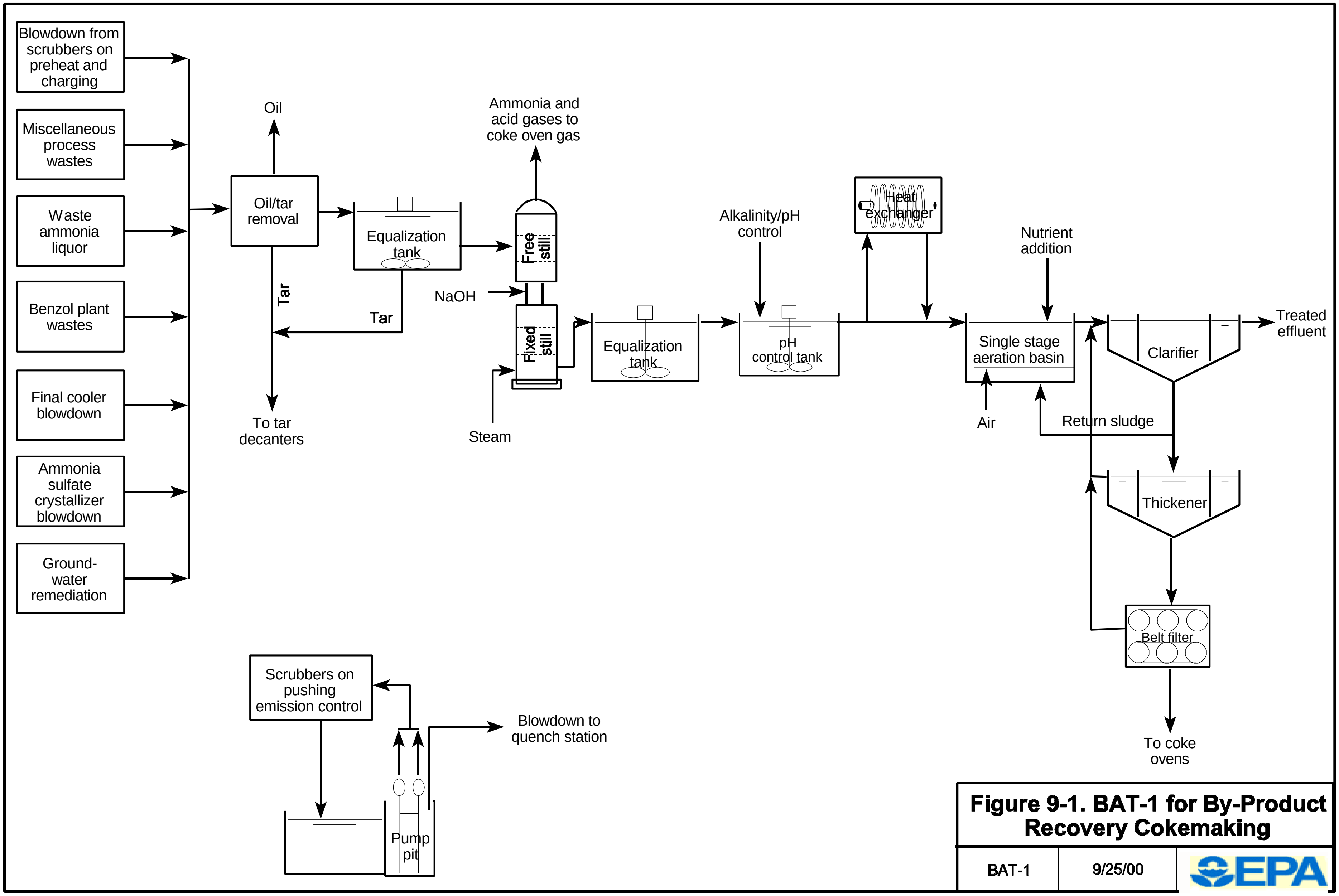


Figure 9-1. BAT-1 for By-Product Recovery Cokemaking

Alkaline Chlorination

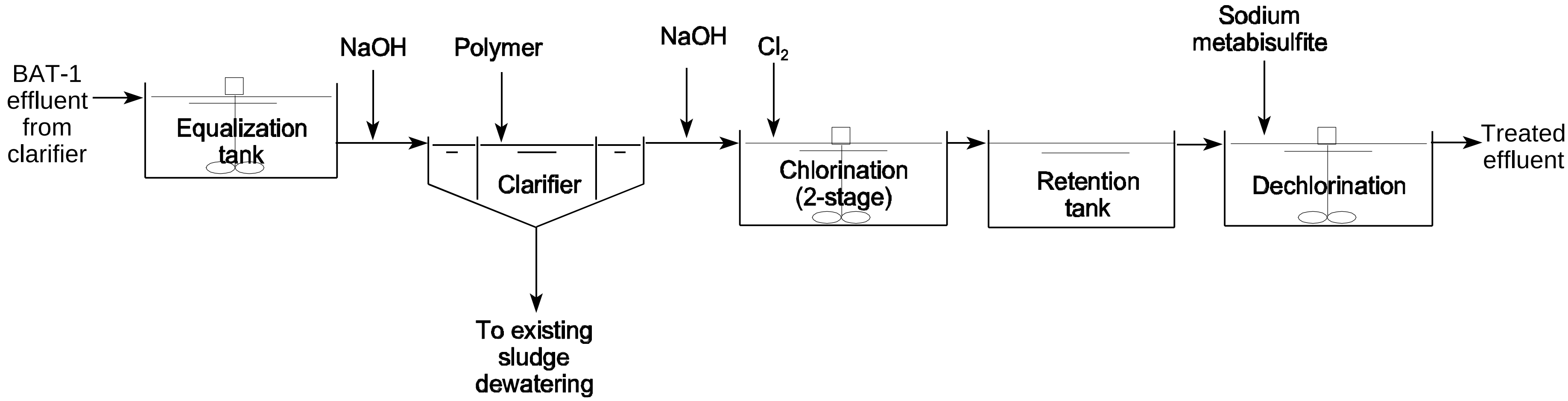


Figure 9-2. BAT-3 for By-Product Recovery Cokemaking

BAT-3	9/25/00	EPA

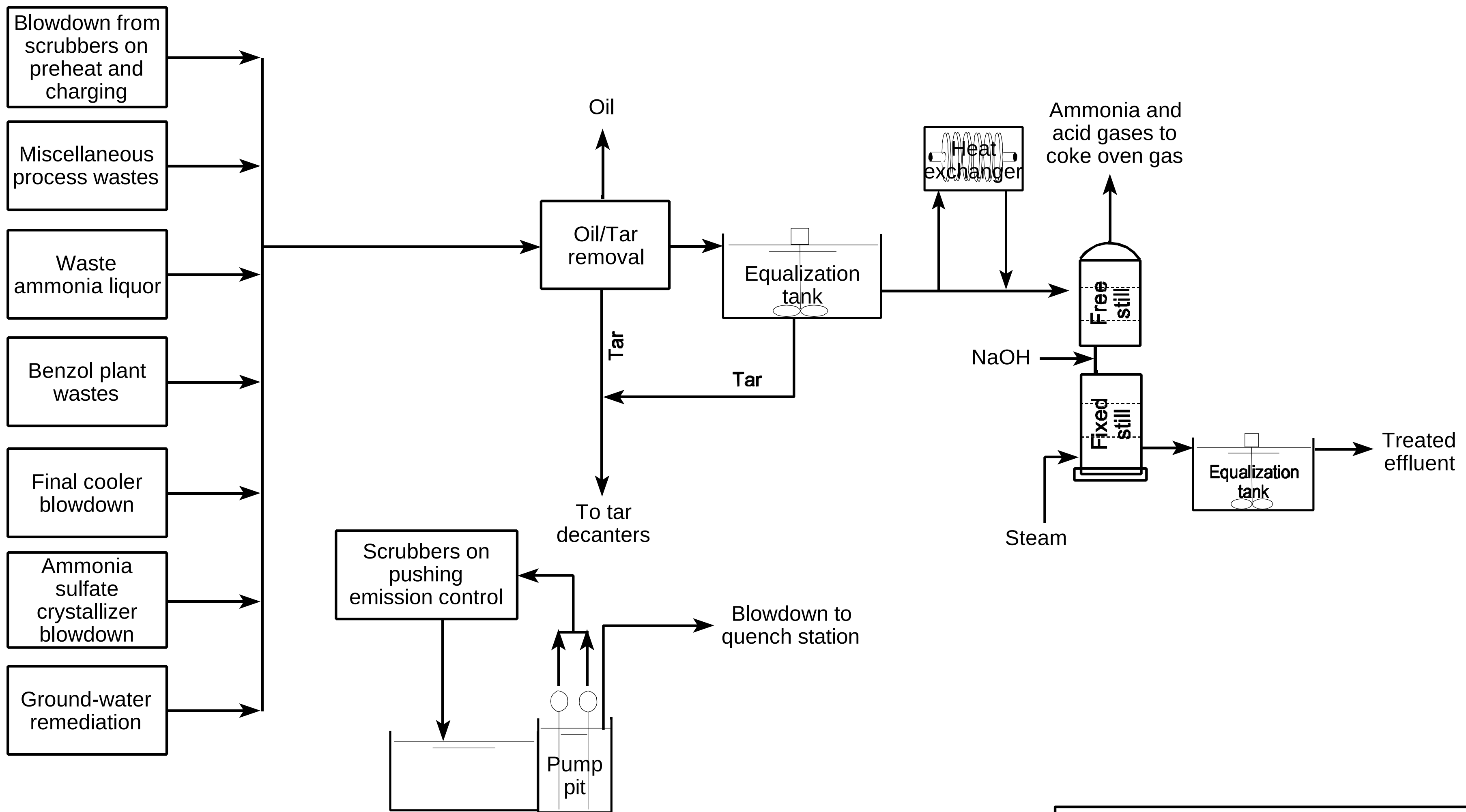


Figure 9-3. PSES-1 for By-Product Recovery Cokemaking

PSES-1 | 9/25/00 | EPA

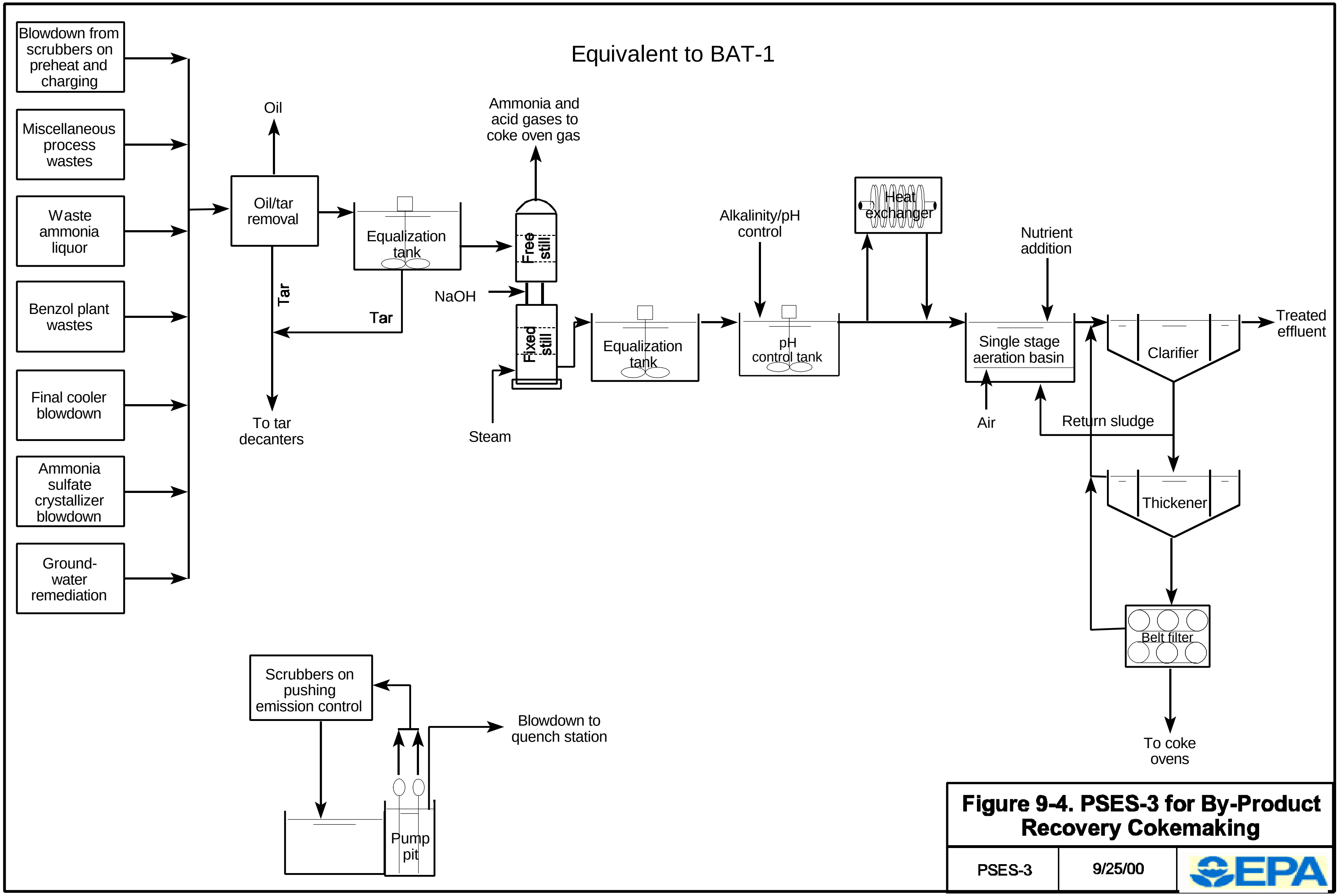


Figure 9-4. PSES-3 for By-Product Recovery Cokemaking

PSES-3 | 9/25/00

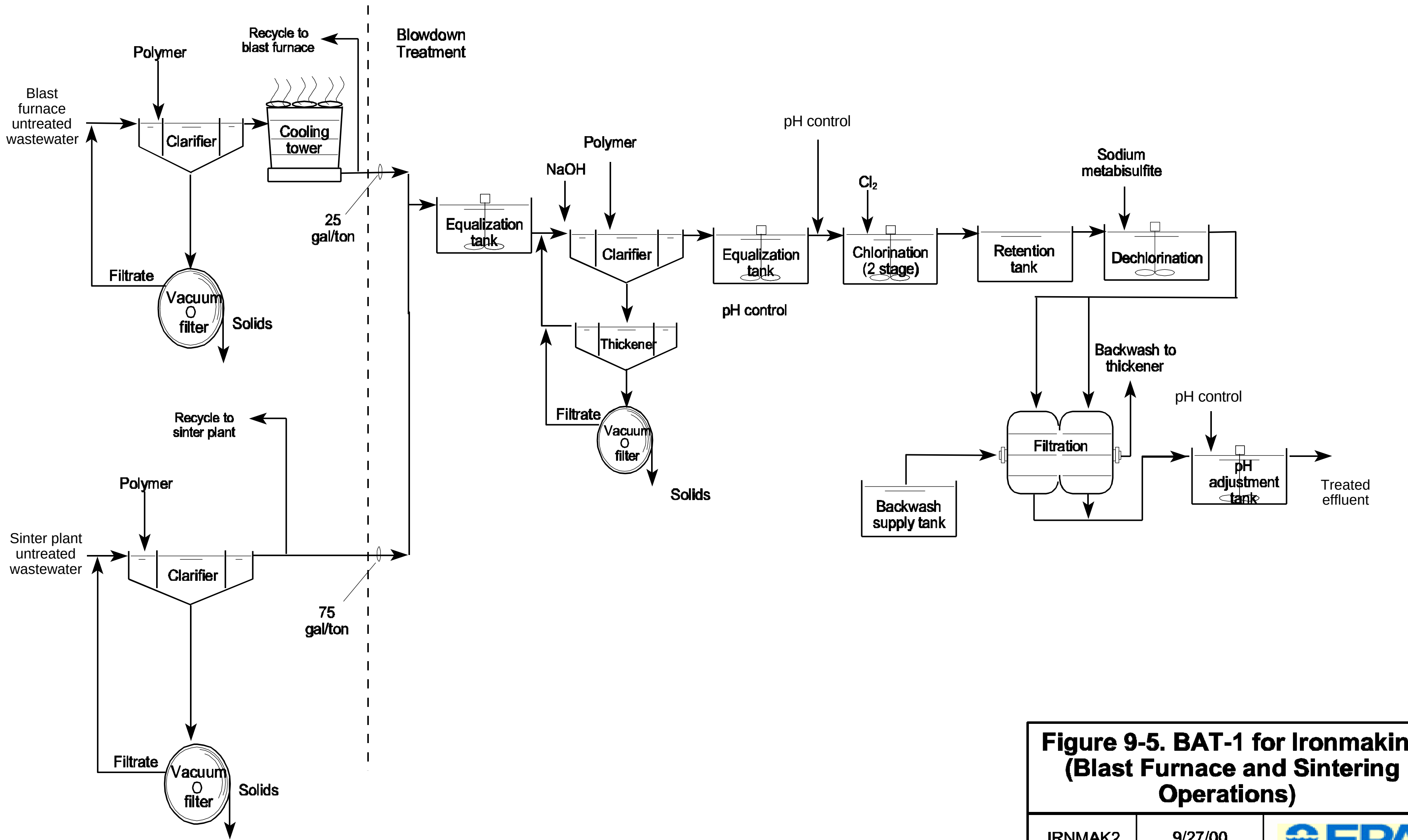


Figure 9-5. BAT-1 for Ironmaking (Blast Furnace and Sintering Operations)

IRNMAK2	9/27/00	EPA

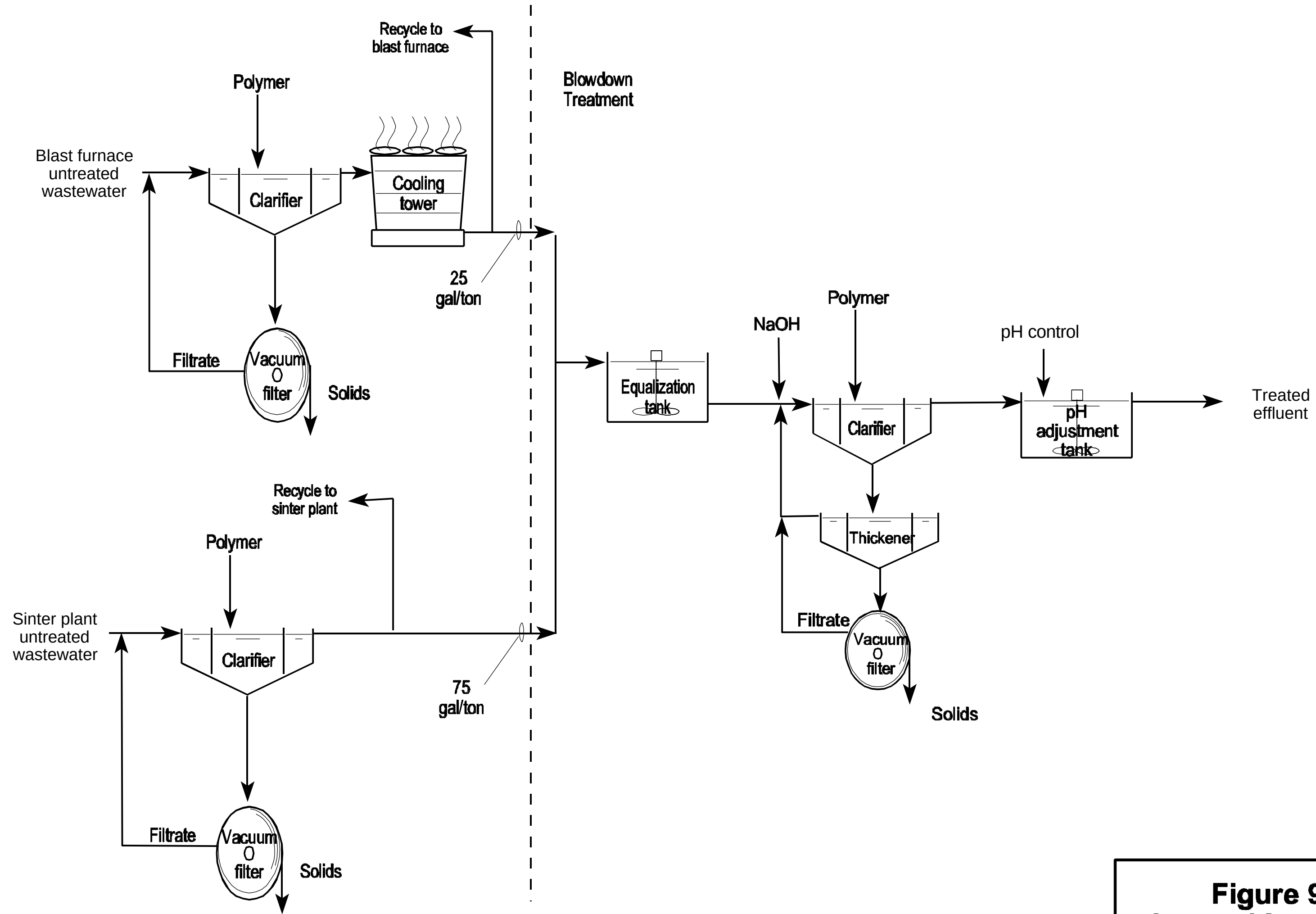


Figure 9-6. PSES-1 for Ironmaking (Blast Furnace and Sintering Operations)

IRNMAK1	9/27/00	EPA

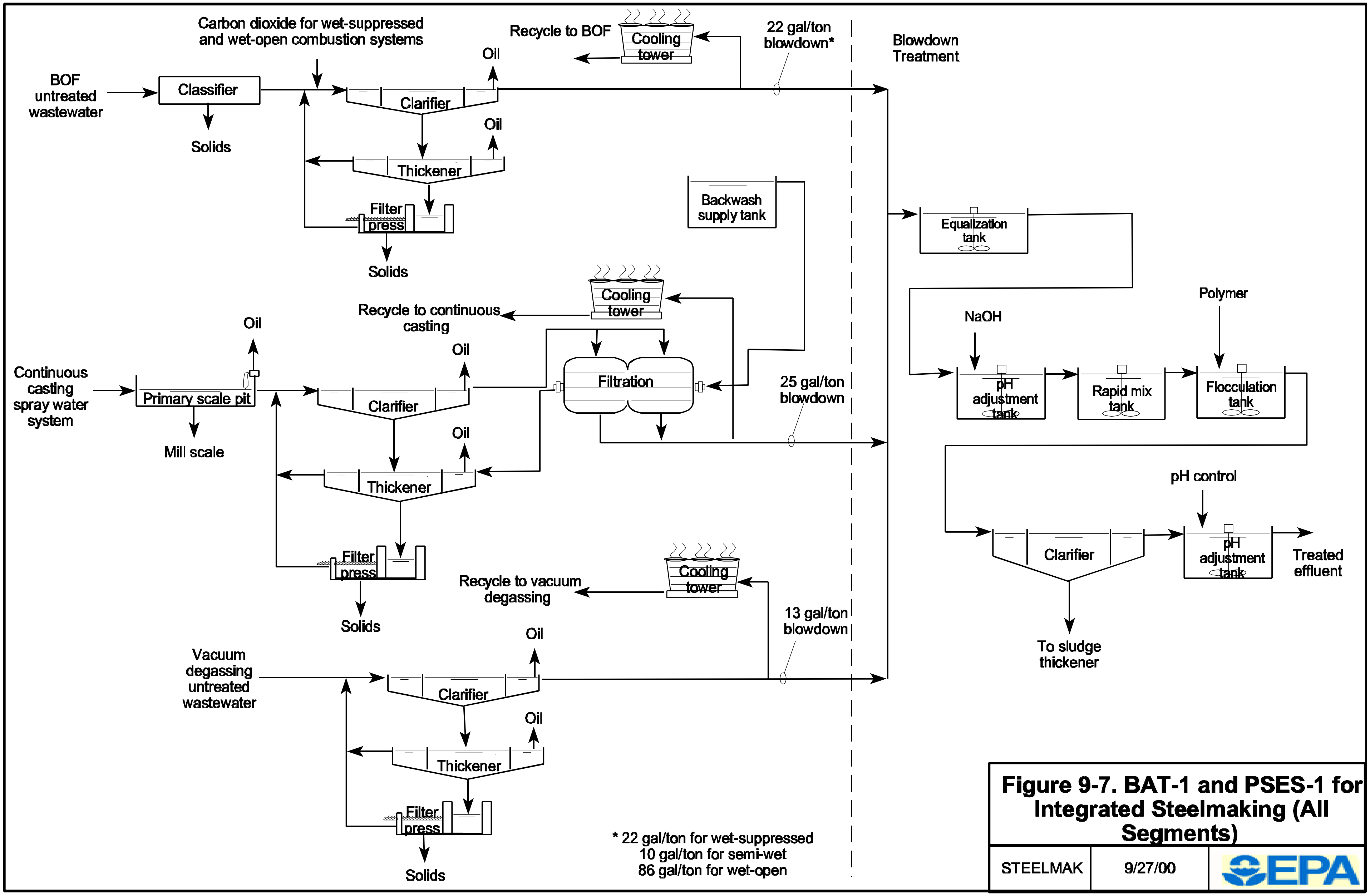


Figure 9-7. BAT-1 and PSES-1 for Integrated Steelmaking (All Segments)

STEELMAK	9/27/00	EPA

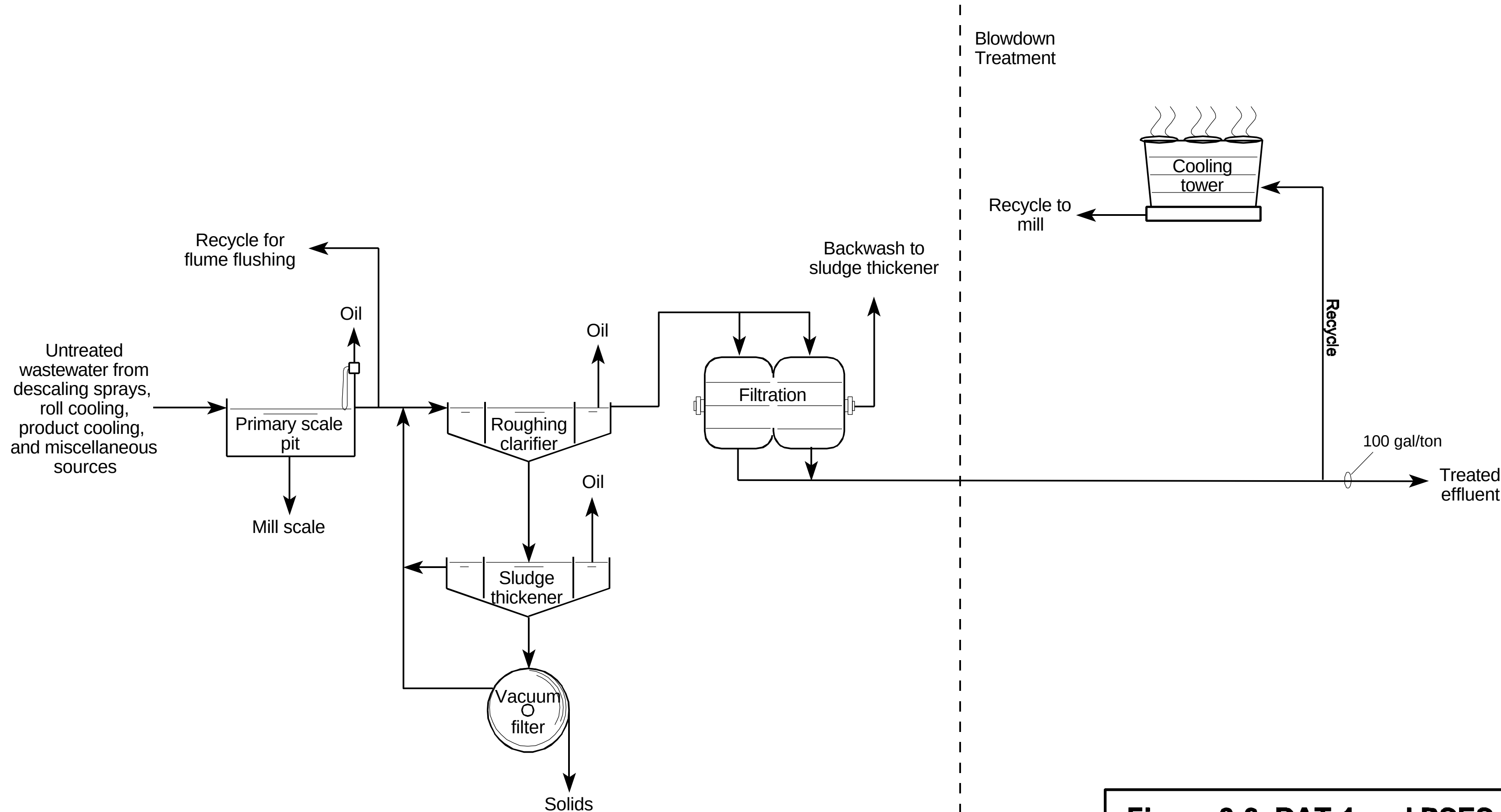
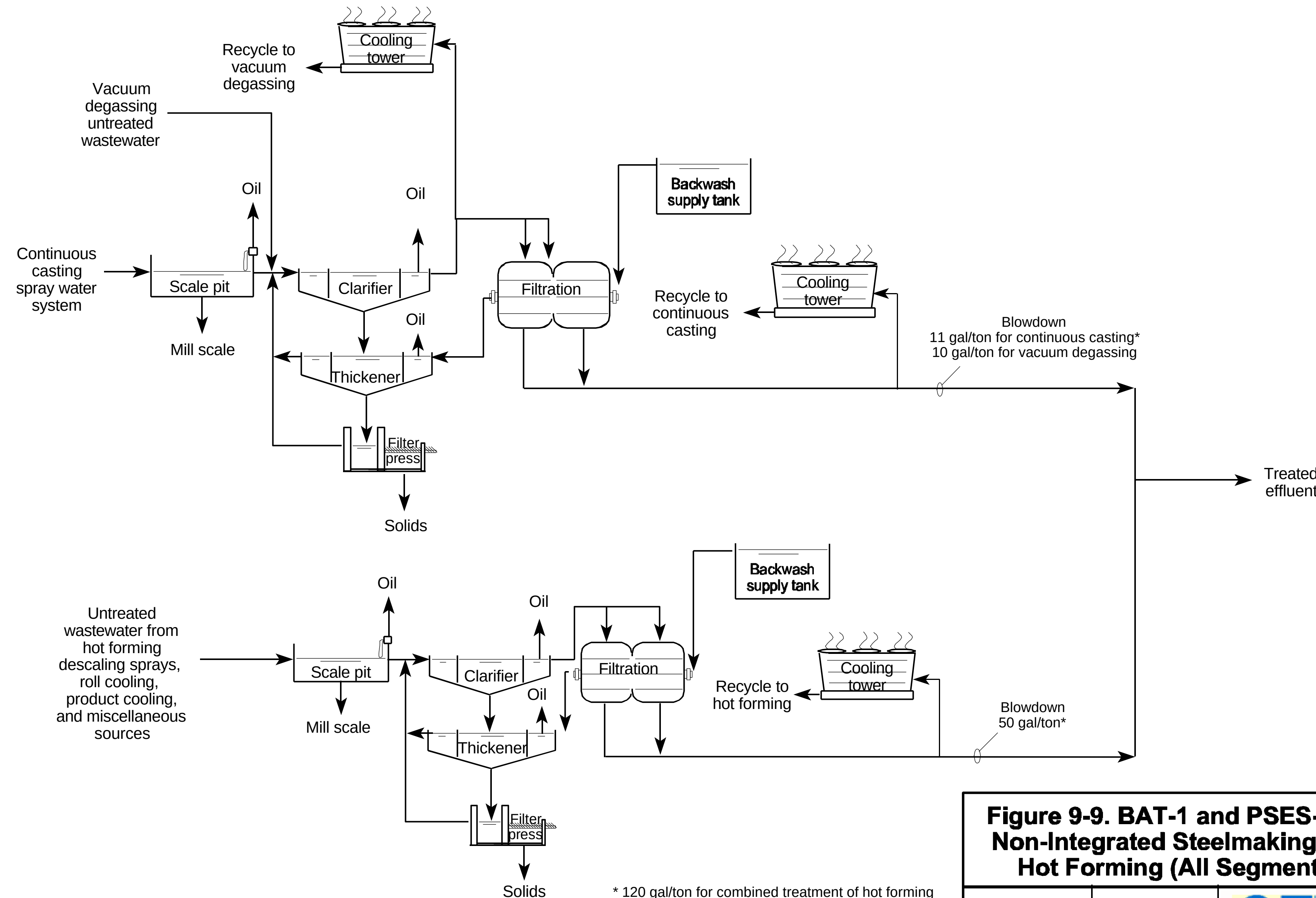


Figure 9-8. BAT-1 and PSES-1 for Integrated and Stand-Alone Hot Forming (All Segments)

HTFRMSA	9/27/00



* 120 gal/ton for combined treatment of hot forming and thin slab casting wastewater

Figure 9-9. BAT-1 and PSES-1 for Non-Integrated Steelmaking and Hot Forming (All Segments)

NONINT1	9/27/00	EPA

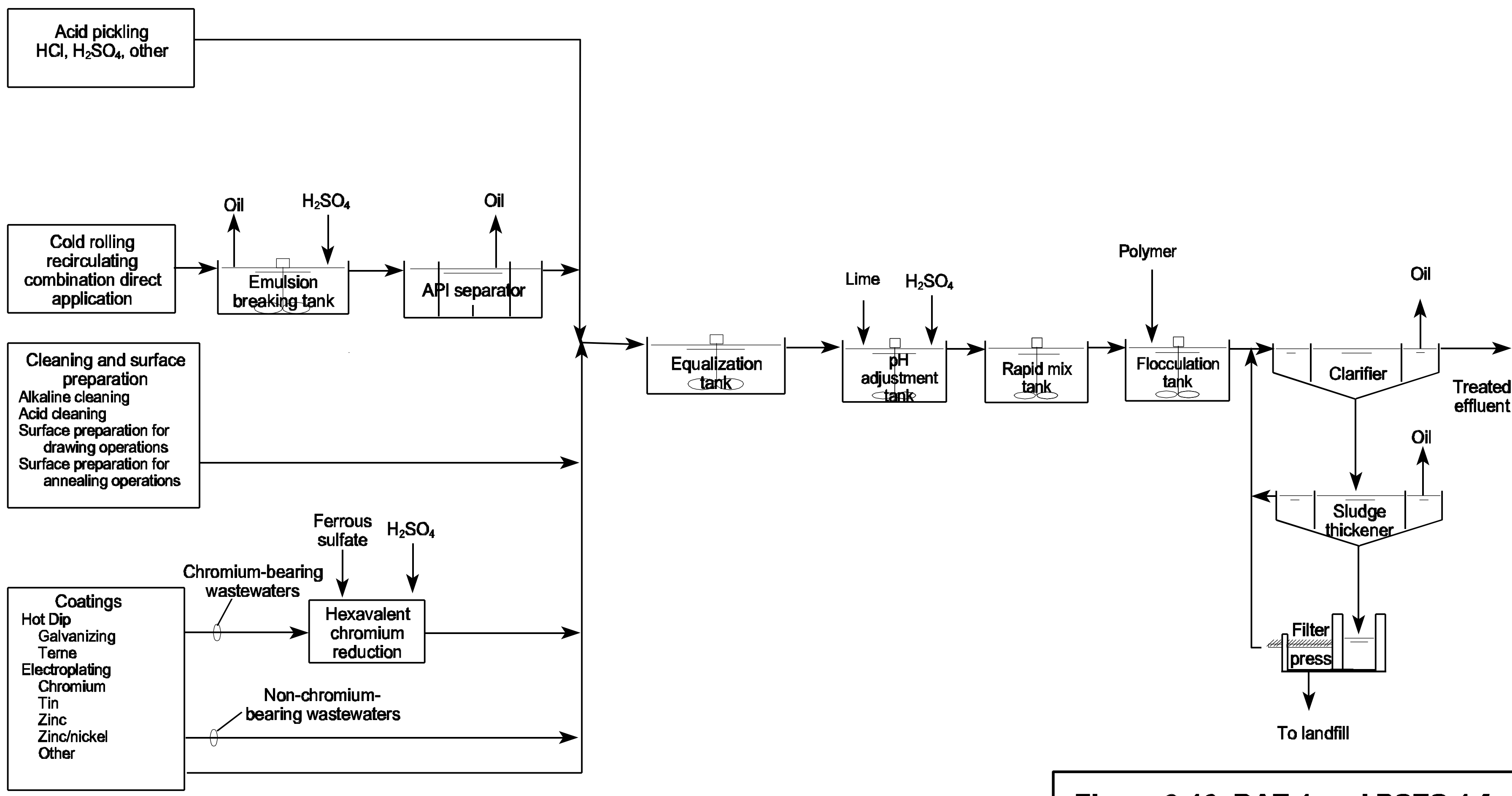


Figure 9-10. BAT-1 and PSES-1 for Carbon and Alloy Steel Finishing

CAR_FINISH	9/27/00	EPA

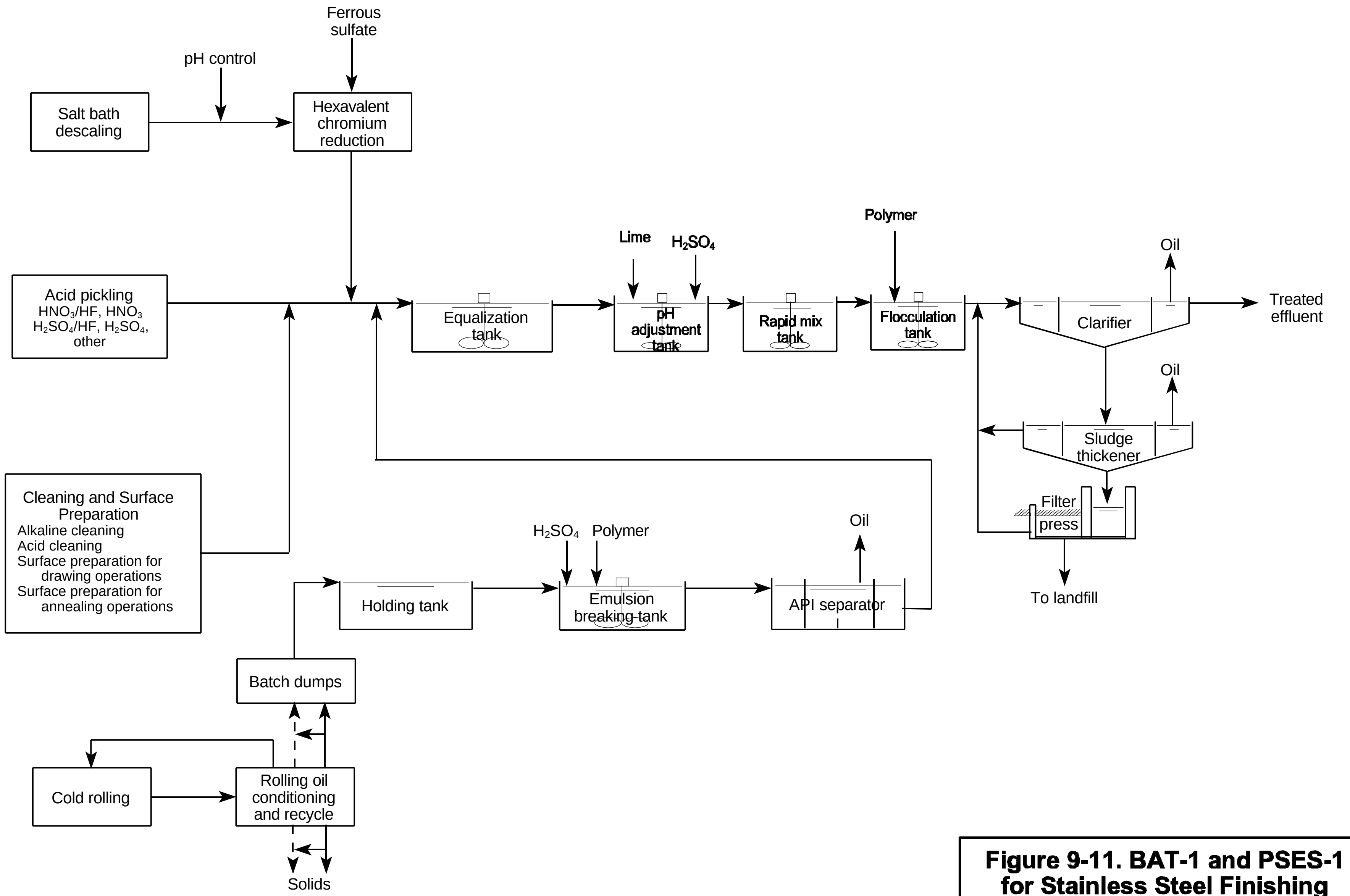


Figure 9-11. BAT-1 and PSES-1 for Stainless Steel Finishing

SPEC_FIN	9/27/00	EPA

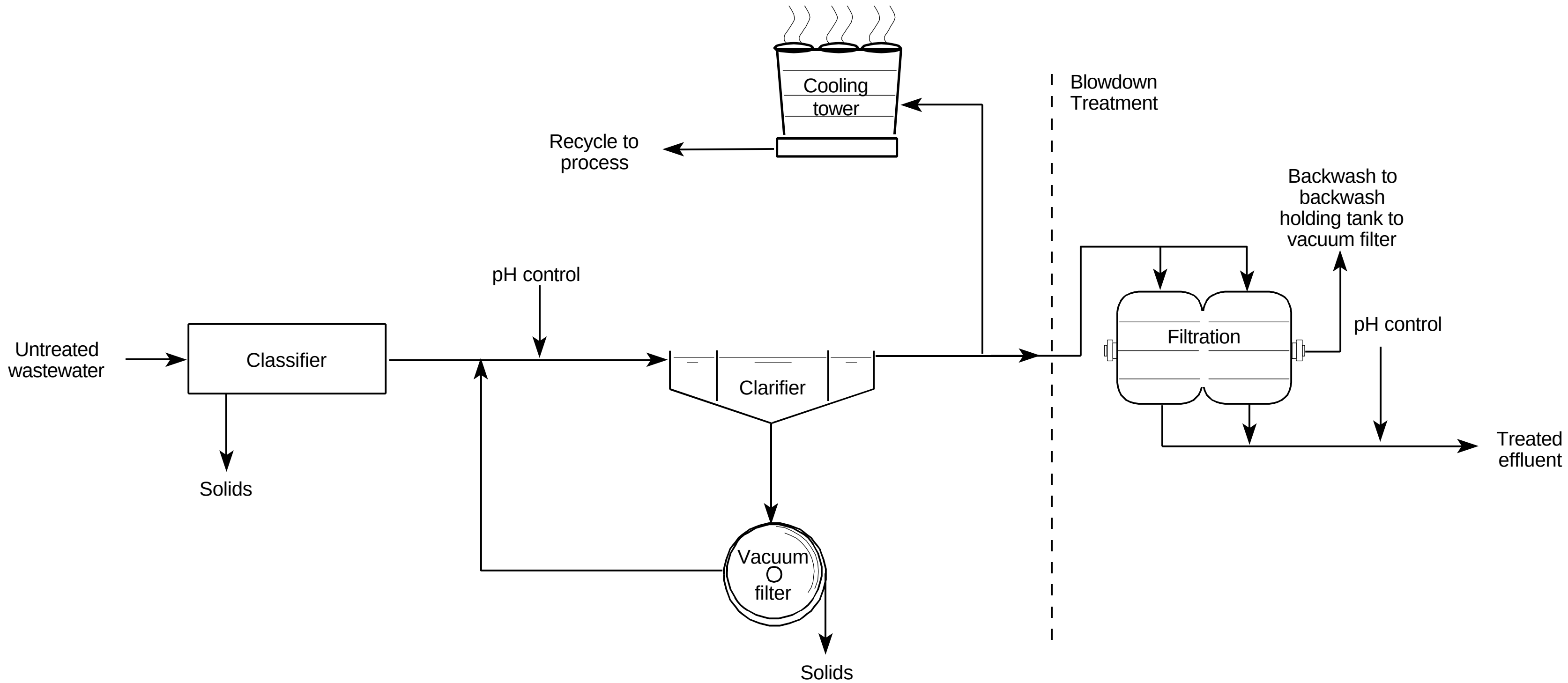


Figure 9-12. BPT-1 for Direct Reduced Ironmaking

DRI | 9/27/00

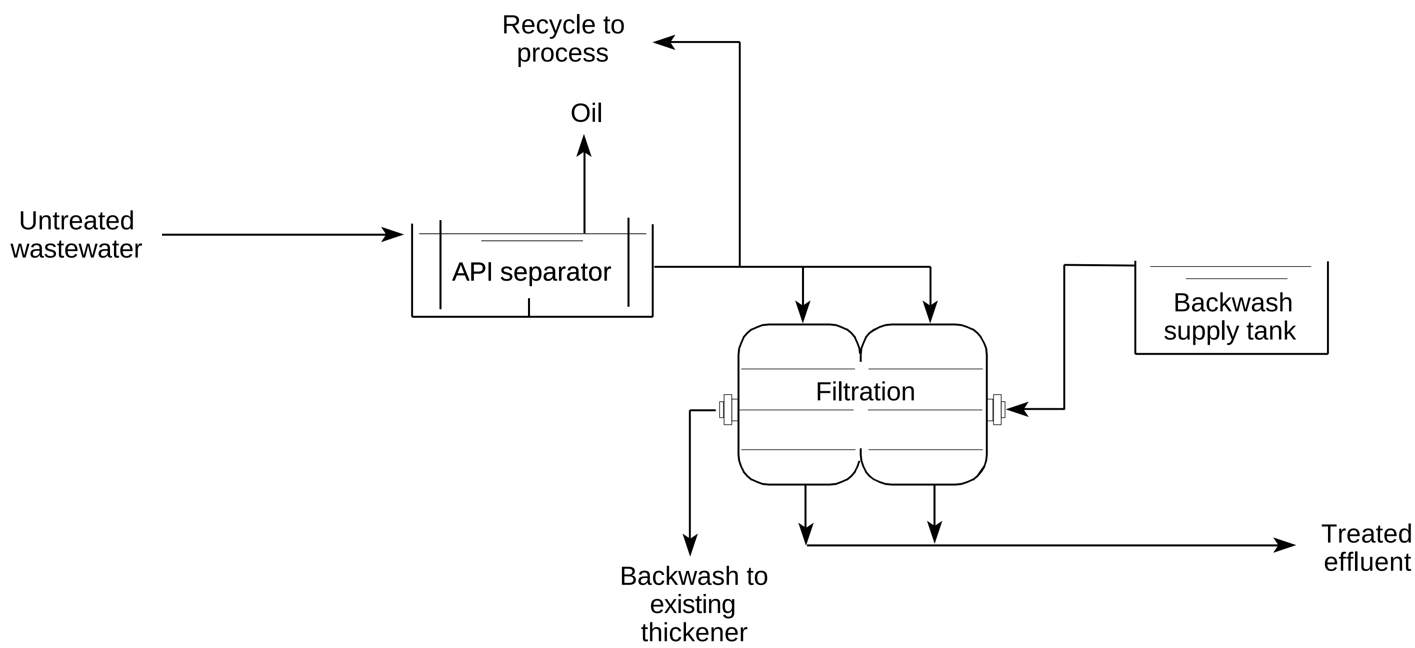


Figure 9-13. BPT-1 for Forging

FORGING	9/27/00

SECTION 10

INCREMENTAL INVESTMENT AND OPERATING AND MAINTENANCE COSTS FOR THE REGULATION

This section presents EPA's estimates of incremental investment costs and incremental operating and maintenance costs for the iron and steel industry to comply with the technology options considered and described in Section 9. EPA estimated the compliance costs for each technology option in order to determine potential economic impacts on the industry. EPA also weighed these costs against the effluent reduction benefits resulting from each technology option. All estimates are based on data collected for the calendar year 1997. Section 11 presents Agency estimates of corresponding annual pollutant loadings and removals for each technology option. The Agency is reporting estimates of potential economic impacts associated with the total estimated annualized costs of the regulation separately (Reference 10-1).

Section 10.1 describes EPA's methodology to estimate costs to achieve the effluent quality for each technology option in each subcategory. Section 10.2 summarizes the results of the cost analyses, by subcategory (arranged according to the proposed subcategorization), for each technology option evaluated.

10.1 Methodology

EPA developed site-specific cost estimates using data collected from industry survey responses and Agency site visits and sampling episodes. Section 3 provides more information on Agency data collection efforts. EPA also solicited data from vendors of various wastewater treatment technologies, obtained data collected by state agencies, surveyed the technical literature, and enlisted the services of an engineering and design firm that has installed wastewater treatment equipment in the iron and steel industry. The Agency also revised subcategory or specific facility cost estimates, as appropriate, to incorporate comments submitted in response to the proposed rule. Section 10.2 discusses these revisions.

As discussed in Section 9, the Agency developed technology options for each iron and steel subcategory. When evaluating costs associated with these technology options, EPA considered the following components of each technology option:

- ***Effluent concentrations.*** EPA used data from sites with treatment technologies representing each technology option to develop model effluent concentrations for each regulated pollutant in a subcategory. Using these same datasets, EPA calculated long-term average effluent concentrations (LTAs) and variability factors for the development of limitations and standards. The Agency re-evaluated LTAs for certain subcategories after proposal. EPA's cost estimates incorporated LTAs revised after proposal. Section 14 discusses the development of LTAs and variability factors for each technology option. Section 12 discusses the regulated pollutants for each subcategory. The Agency used data supplied through industry survey responses and other sources to determine LTAs of each regulated pollutant reported by all of the sites evaluated in the costing analysis.

- ***Treatment technology.*** EPA considered the in-process controls, pollution prevention measures, and end-of-pipe treatment units comprising each technology option as model pollution control technologies.

- ***Production-normalized flow rates (PNFs).*** EPA developed model PNFs representing appropriate process water management and water conservation practices for each technology option. When developing model PNFs, the Agency took into account the nature of subcategory process operations, the rates at which water was applied to processes, recirculating process water quality requirements, and good water management practices. The Agency re-evaluated model PNFs after proposal. EPA's cost estimates incorporated PNFs revised after proposal. For more information on the development of model PNFs, refer to Section 13.

The Agency considered these components of each technology option to judge whether wastewater treatment units, entire treatment or high-rate recycle systems, or modifications in operating practices would be necessary for individual sites to achieve model pollutant loadings for a particular technology option. EPA calculated model pollutant loadings by multiplying the model PNFs and model LTAs discussed in Sections 13 and 14, respectively. For each technology option, EPA compared the model pollutant loadings for each regulated pollutant with baseline loadings calculated for each site to assess water management practices and wastewater treatment performance at sites. The Agency calculated pollutant loadings for each site from the sources identified in Section 11. If it determined that a site exceeded the model pollutant loadings for a technology option, then EPA compared the technology in place and its operation at the site with the technology basis for the option. EPA evaluated industry survey responses to determine wastewater treatment technologies used at sites. Tables 9-1 through 9-7 in Section 9 summarize the results of the technology-in-place analysis for each iron and steel subcategory. EPA then determined the amount of investment, operating and maintenance, and/or one-time costs for those equipment items, water management practices, or operating and maintenance practices that would be incurred if sites in each subcategory were to implement the model technology options.

Sites can use many possible combinations and variations of the treatment system components of the technology bases considered to achieve the effluent limitations and standards considered for this rule. In some instances, the Agency observed that sites operate additional or equivalent treatment technologies to those considered for this rule.

For some survey respondents, effluent concentration data were not available for certain regulated pollutants or available effluent concentration data corresponded to outfalls that contained substantial amounts of noncontact cooling water or non-process wastewater. In these cases, the Agency used PNFs and technology in place solely to assess pollution control performance.

Several survey respondents reported cotreating wastewater generated from manufacturing operations associated with multiple subcategories at a wastewater treatment plant that discharged treated effluent through a single, permitted outfall. In these cases, EPA compared the sum of the model pollutant loadings for each applicable subcategory to the pollutant loadings calculated from effluent concentration and flow data corresponding to these combined treatment outfalls. Where it determined that a site exceeded the sum of the applicable model pollutant loadings, EPA estimated the cost to treat and/or recycle wastewater from each applicable subcategory in separate treatment and/or high-rate recycle systems consisting of the applicable model treatment technologies.

EPA developed an electronic design and cost model to estimate costs using the methodology described above. Sections 10.1.1, 10.1.2, and 10.1.3 describe how EPA developed cost equations for use in this model to estimate investment, operating and maintenance, and one-time costs associated with various pollution control technologies, respectively. For certain blast furnace, continuous casting, and hot forming operations lacking high-rate recycle systems, EPA developed cost estimates on a site-specific basis independent of the cost model noted above (see Section 10.1.1).

EPA estimated costs for the iron and steel industry for the base year 1997. The Agency included sites (or operations) in the costing analysis if a site operated at least one day during the 1997 calendar year. Even if a site (or operation) shut down after 1997, it was retained in the costing analysis, except for one site. This site shut down operations after 1997 and EPA was unable to verify costing assumptions and the site's reported high flow; therefore, this site was removed from the costing analysis. However, if a site (or operation) commenced after 1997, EPA did not include the site (or operation) in the costing analysis. For some sites, 1997 data did not represent normal operating conditions; for those sites, EPA used data from alternate years. Several sites operated during only part of 1997 because of strikes, shut downs, or start-ups. For these sites, EPA used production, analytical, and flow rate data from years that the sites indicated were representative of normal operations. If sites installed or significantly altered wastewater treatment systems after 1997, EPA used the data that represented the wastewater treatment configurations as of 1997. For more information regarding the use of 1997 data in EPA’s analyses, refer to Section 3.

EPA excluded from the cost analysis sites reporting zero discharge of wastewater. The Agency assumed that these sites will continue to operate in this manner and that effluent limitations will not apply to them because no process wastewater is discharged to POTWs or surface waters.

10.1.1 Investment Costs

For each wastewater treatment facility in each subcategory, EPA determined the equipment items necessary to achieve the model pollutant loadings following the methodology described in Section 10.1. The Agency estimated investment costs for the following components:

- ***Equipment:*** Purchased equipment items, including freight;

- ***Installation:*** Mechanical equipment installation, piping installation, civil/structural work (site preparation and grading, construction of equipment foundations and structural supports), materials and labor to construct buildings or enclosed shelters, and electrical and process control instrumentation;

- ***Indirect costs:*** Costs for temporary facilities during construction and installation, spare parts, engineering procurement and contract management, commissioning and start-up, and labor costs for site personnel to oversee equipment installation (owner team costs); and

- ***Contingency:*** Additional costs to account for unforeseen items in vendor and/or contractor estimates.

The Agency developed investment cost estimates using the following data sources:

- ***Engineering and Design Firm***. EPA enlisted an engineering and design firm to estimate investment costs for design flow rates spanning the range of actual industry flow rates for the following treatment systems, which comprise various technology options considered for this rulemaking:

  — Granular activated carbon filtration of cokemaking wastewater (component of BAT-4, by-product recovery cokemaking segment),

  — Breakpoint chlorination of cokemaking wastewater (component of BAT-3 and PSES-4, by-product recovery cokemaking segment),

  — Metals precipitation of blast furnace and sintering wastewater (component of BAT-1 and PSES-1, ironmaking subcategory),

  — Breakpoint chlorination of blast furnace and sintering wastewater (component of BAT-1, ironmaking subcategory),

  — Metals precipitation of basic oxygen furnace steelmaking, vacuum degassing, and continuous casting wastewater (component of BAT-1 and PSES-1, integrated steelmaking subcategory), and

  — Polishing of wastewater through multimedia filtration (component of BAT-4, by-product recovery cokemaking segment; BAT-1, ironmaking subcategory; sintering subcategory; BAT-1 and PSES-1, integrated and stand-alone hot forming subcategory; and BAT-1 and PSES-1, non-integrated steelmaking and hot forming subcategory).

The engineering and design firm developed investment costs for these treatment systems by determining equipment requirements and specifications according to the specified design flow rates. The firm did not use cost factors to estimate installation costs; instead, it provided line-item estimates for mechanical equipment installation, piping installation, equipment foundations (including site preparation and grading), equipment structural support, buildings, and electrical and process control instrumentation. Figures 10-1 through 10-6 present these treatment systems and Table 10-1 presents the assumptions used to develop these cost estimates. These assumptions represent typical considerations for add-on treatment technologies for existing wastewater treatment systems and are based on EPA's examination of industry survey responses, Agency site visits, and engineering and design firm experience. Tables 10-2 through 10-13 present corresponding design specifications and itemized cost sheets. Note that installation costs were based on a union labor rate of $60 per hour, which is based on an engineering and design firm's experience with actual wastewater treatment installations in the iron and steel industry. EPA then developed equations for use in the computerized cost model as described below.

To estimate investment costs for treatment systems and units other than those specified above, EPA used cost data obtained from capital cost survey responses and vendor quotes (described below) in conjunction with cost factors. The engineering and design firm developed cost factors to estimate installation costs associated with the following:

— Shipping of equipment,

— Labor for mechanical equipment installation,

— Site preparation and grading,

— Equipment foundations and structural support,

— Buildings to house treatment equipment and provide enclosed shelter,

— Purchase and installation of piping,

— Electrical and process control instrumentation,

— Temporary facilities during construction and installation,

— Spare parts,

— Engineering procurement and contract management,

— Commissioning and start-up,

— Labor costs for site personnel to oversee equipment installation, and

— Contingency costs.

Table 10-14 lists the cost factors that EPA used, in conjunction with cost data from capital cost survey responses and vendor quotes, to estimate installed costs of various treatment systems and units for this rulemaking. Note that EPA based these cost factors on an evaluation of past project costs and budgetary estimates for actual wastewater treatment installations in the iron and steel industry. Furthermore, these cost factors reflect installation costs based on typical union labor rates and durations. The Agency estimated the investment costs of treatment units for various design flow rates by multiplying the purchased equipment cost (developed from vendor and capital cost survey data, as described below) by approximately 355 percent (the sum of the cost factors listed in Table 10-14). EPA then plotted investment cost versus the design flow rate to develop cost equations for use in its cost model. The Agency performed a regression analysis on this data and determined that a linear relationship was the 'best fit' between the costs and flow rates in the flow ranges considered. For treatment units that were costed across a wide range of flow rates, EPA extrapolated separate lines for incremental flow ranges. Otherwise, the Agency used the median cost per gallon per minute to estimate investment costs.

- ***Vendor and Capital Cost Survey Data.*** The Agency developed cost estimates for purchased equipment and ancillary equipment (pumps, piping, sumps, etc.) for various sizes of the technology basis components for each option using data from capital cost survey responses and vendor quotes. As described above, EPA used this cost data in conjunction with cost factors to estimate investment costs.

Table 10-15 summarizes the investment cost equations used to estimate costs for technology option components, the applicable subcategories and technology options, and the sources of these estimates (engineering and design firm or capital cost surveys and vendor information). Additional information on the development of cost equations for equipment items derived from capital cost survey and vendor data are located in Section 14.5 of the Iron and Steel Administrative Record, DCN IS10825.

EPA identified several sites with once-through wastewater treatment systems that would need to invest in high-rate recycle systems to achieve model PNFs for some technology options. EPA determined equipment items necessary to achieve high-rate recycle and gathered site-specific information from Agency surveys, site visits, and sampling episodes conducted during this rulemaking. Because these systems are complex and not amenable to a standardized costing approach, the Agency requested the engineering and design firm to estimate investment costs on a site-specific basis using available site-specific information and data.

When estimating costs for sites for entire high-rate recycle or wastewater treatment systems (which would likely need significant land area), the Agency took into account land availability, when such data were available. For sites for which EPA estimated costs for add-on technologies needing minimal space, the Agency assumed, based on its experience in visiting many industrial sites, that additional space for those technologies was available near existing wastewater treatment systems.

EPA sized wastewater treatment components for each site according to flow rates reported in the industry survey responses. When industry survey responses indicated that existing treatment systems also treated non-process water such as ground water, storm water, or noncontact cooling water, the Agency also included those flows. While EPA does not believe that these other sources should be treated with process water in all cases, flow rates from these sources were included to adequately size wastewater treatment components. For sites that EPA estimated would install new blowdown treatment systems to achieve model treatment system effluent quality, the Agency sized these blowdown treatment systems according to model PNFs (in gallons per ton). EPA sized these blowdown treatment systems by multiplying a site's reported production rate by the model PNF.

10.1.2 Operating and Maintenance Costs

EPA developed estimates of incremental operating and maintenance costs by evaluating operating and maintenance cost data from the detailed and short surveys, supplemented with data from other sources, specified below. EPA used data reported in survey responses when available. The Agency estimated operating and maintenance costs for the following items:

- ***Labor.*** Labor costs associated with general operating and maintenance of treatment equipment. EPA used a labor rate of $29.67 per hour to convert the labor requirements of each technology into annual costs. The Agency obtained a base labor rate from the Monthly Labor Review, which is published by the U.S. Bureau of Labor Statistics of the U.S. Department of Labor (Reference 10-2). The Agency averaged monthly values for 1997 for production labor in the blast furnace and basic steel products categories to obtain a base labor rate of approximately $20.90 per hour. Forty-two percent of the base labor rate was then added for overhead. EPA derived this percentage to account for medical and dental insurance, vacation, sick leave, unemployment tax, workman's compensation, and retirement benefits to obtain the $29.67-per-hour labor rate. The Agency based this percentage on typical employer costs for hourly employees. Industry survey responses indicated labor rates between $13.00 and $85.64. The median labor rate reported by industry surveys was $28.95.

Data collected from industry survey responses, site visits, and other contacts with the industry show that the great majority of wastewater treatment systems are staffed on a 24-hour basis. This includes complex wastewater treatment systems for by-product recovery cokemaking, ironmaking, and steelmaking operations; hot forming operations with mechanical treatment systems; steel finishing operations where wastewater from multiple processes are cotreated; and treatment facilities that cotreat wastewater generated from manufacturing operations from multiple subcategories. Consequently, the Agency used 24-hour staffing as the baseline labor staffing complement, where applicable. EPA estimated incremental labor hours associated with the assigned wastewater treatment system upgrades based on additional operating and maintenance requirements. These additional labor hours were then multiplied by the $29.67-per-hour labor rate to assess incremental labor cost impacts of the technology options.

- ***Maintenance.*** Costs (excluding labor costs) associated with upkeep of equipment, repairs, operating supplies, royalties, and patents. When these costs could not be estimated based on industry survey responses, the Agency assumed annual maintenance costs to be 6 percent of the investment cost of equipment (Reference 10-3). Maintenance costs reported by industry ranged from 0.2 percent to 6.3 percent of investment costs. The median maintenance cost, as a percentage of investment costs, reported by industry was 1.1 percent.

- ***Chemicals.*** Costs for chemicals used for various high-rate recycle and wastewater treatment technologies. EPA evaluated industry survey responses to determine chemical usage rates for well-operated treatment and recycle systems. When costs for chemicals could not be estimated based on industry survey responses, the Agency obtained chemical prices from vendors or from the Chemical Marketing Reporter from December 1997 (Reference 10-4), as follows:

  — Sodium hydroxide (50 percent wet weight): $0.15 per pound,

  — Sulfuric acid (98 percent solution): $0.043 per pound,

- Sodium bisulfite (dry crystals in bags): $0.325 per pound,
- Sodium hypochlorite (100 percent, typically purchased as a 12 percent solution): $1.47 per pound,
- Polymer, generic (dry pellets in bags or 5-gallon pails): $0.20 per pound,
- Biocide: $0.004 per gallon,
- Scale inhibitor: $0.19 per pound,
- Lime (hydrated lime powder in 100 pound bags): $0.035 per pound,
- Soda ash (powder in 100-ton hopper cars): $0.05 per pound, and
- Ferric sulfate (solid in bags): $0.0705 per pound.

• ***Energy.*** Incremental energy requirements and costs associated with operation of additional pollution control equipment. In general, additional energy requirements were a result of new or upgraded high-rate recycle and treatment systems equipped with electric motors to drive water pumps, chemical mixers, aeration equipment such as blowers and compressors, and cooling tower fans. When energy costs for equipment could not be estimated based on industry survey responses, EPA obtained electricity prices from the U.S. Department of Energy's Energy Information Administration's average industrial electrical costs in 1998 (Reference 10-5). The average electrical cost to industrial users between 1994 and 1997 was $0.047 per kilowatt hour (kWh). Section 15 presents the estimated energy requirements and a more detailed discussion of the methodology used to develop these estimates for each technology option. The median electrical cost reported in industry surveys was $0.04 per kWh.

• ***Sludge/Residuals (Hazardous/Nonhazardous) Disposal.*** Cost of disposing of generated sludge. The Agency calculated incremental sludge generation rates associated with each technology option. Section 15 presents the methodology and results for this analysis. After considering sludge generation rates, sludge disposal destinations, and sludge disposal costs, the Agency determined that the incremental cost associated with sludge disposal for any technology option would be impacted by less than 0.5 percent. Therefore, EPA has not included costs associated with sludge disposal in cost estimates, except for incremental costs associated with sludge disposal for technology options PSES-3 and PSES-4 of the by-product recovery cokemaking segment of the cokemaking subcategory.

The Agency calculated site-specific sludge disposal costs for these technology options because several sites would generate and dispose of sludge associated with biological treatment, where no sludge of this nature was previously generated at the sites.

- ***Sampling/Monitoring.*** Incremental sampling and monitoring costs to determine compliance with permits or performance of treatment systems. Because of the operational complexity associated with breakpoint chlorination, biological treatment, and cyanide precipitation, the Agency estimated additional costs to sample and monitor treatment performance. The basis for these costs are provided in Section 14.5 of the Iron and Steel Administrative Record, DCN IS10825. EPA also estimated additional compliance sampling and monitoring costs for 2,3,7,8-tetrachlorodibenzofuran, which is not currently regulated under 40 CFR 420, at sinter plants because of the significant costs associated with these analyses. These costs were estimated to be $12,000 per year per site based on analyses using EPA Method 1613B at a monitoring frequency of once per month. The Agency did not incorporate monitoring cost savings realized at cokemaking sites attributable to the elimination of benzene as a regulated pollutant for BAT limits. EPA did not include in its analysis additional costs incurred by existing indirect discharge sites to monitor for naphthalene (which typically occurs monthly at an estimated cost of $1,500); however, this additional cost is offset by a monitoring cost savings realized through the elimination of total phenolics (4AAP) as a regulated pollutant for PSES. Monitoring frequency requirements for total phenolics are typically once per week and are estimated to cost approximately $2,100 annually per site. For the direct-reduced ironmaking and forging segments of the other operations subcategory, EPA did not incorporate additional monitoring costs for analyses for total suspended solids and oil and grease because of the low costs associated with these analyses and because most sites in this subcategory currently monitor for these pollutants.

Table 10-16 presents the equations used to calculate incremental operating and maintenance costs for additional treatment equipment, along with the range for which the equations are applicable. The table footnotes listed on the last page of Table 10-16 provide information sources and/or assumptions used in developing the cost equations. A more detailed description of the development of these costs for each equipment item is provided in Section 14.5 of the Iron and Steel Administrative Record, DCN IS10825.

10.1.3 One-Time Costs

One-time costs are non-capital costs that cannot be depreciated because they are not associated with property that can deteriorate or wear out. For tax purposes, a one-time non-capital cost is expensed in its entirety in the year it is incurred. When estimating costs for the industry to comply with the regulatory options considered for this rulemaking, EPA incorporated one-time costs into cost analyses in instances described below.

When assessing costs for technology options consisting of biological treatment for the cokemaking subcategory and chemical precipitation for the steel finishing subcategory, EPA found that analytical data from some survey responses showed that, despite having treatment equipment equivalent to a technology option, PNFs or effluent concentrations of certain facilities exceeded model values. In such cases, the Agency evaluated pollution control system design and operating parameters to determine additional investment and operating and maintenance costs necessary to achieve the model PNFs and LTAs. If a site's design and operating parameters were not equivalent to model operating parameters or if these parameters were not provided in a site's survey response, the Agency allocated a one-time cost for hiring an outside consultant to upgrade wastewater treatment system performance (e.g., improve site operation and maintenance to optimize biological treatment system performance) in addition to capital and operating and maintenance costs associated with this upgrade.

Optimizing the performance of a biological treatment system at cokemaking sites requires an extensive analysis of both operating parameters and treatment chemistry. This type of an analysis usually requires an engineering consultant spending one to two weeks on site as well collecting daily data on influent and effluent concentrations, alkalinity, sludge wasting rates, mixed liquor volatile solids concentrations in the aeration basin, nutrient additions, temperature, and dissolved oxygen requirements for up to 28 days at the facility. Based on the data collected from this analysis, the consultant can recommend operational and/or design changes that will improve the system performance. Once the changes suggested by the consultant have been made, it may take several weeks to several months for the system to stabilize enough to verify that it can achieve the target effluent quality. EPA estimated consultant costs to range between $80,000 and $100,000 for sample collection, data analysis, engineering design and operational changes, and measuring the impact of the operational and design changes on system performance. Such an analysis may result in one or many modifications to the treatment system. For the purpose of estimating costs, EPA selected design and operational modifications related to four treatment system parameters for sites with biological treatment systems that do not achieve model treatment performance: aeration capacity, alkalinity, nutrient addition, and system control. Additional information on these parameters and the basis for the one-time, capital, and operating and maintenance costs associated with these modifications are located in Section 14.5 of the Iron and Steel Administrative Record, DCN IS10825.

Optimizing the performance of a chemical precipitation treatment system at a steel finishing site typically requires an extensive analysis of both operating parameters and treatment chemistry by a trained engineering consultant. The consultant uses bench-scale jar testing as a tool to optimize treatment system performance. Jar testing involves adding various chemical precipitants and polymers to small amounts of a representative wastewater to determine which most reduces overall effluent metals and suspended solids concentrations. Tests at various pHs and chemical dosages are also conducted. Jar testing is usually conducted at an off-site laboratory by trained chemists. Typical costs consist of sample collection, jar testing, laboratory analyses of lead and zinc, and preparation of a treatability report by the laboratory. In addition to jar testing costs, the consultant may spend one to three weeks on site collecting daily data on influent and effluent concentrations, chemical additions, pH variations, and wastewater flow patterns. Based on the data collected from the on-site analysis, coupled with the jar testing results, the consultant can recommend design and/or operational changes to improve the performance of the system. EPA estimated the total consultant cost in this case to be $40,000 to $65,000. This estimate is based on the following : a maximum of 450 hours of direct labor (180 hours of field work, 270 hours of office work) at a labor rate of $100 per hour; approximately $5,000 for airfare, food, lodging, car rental, and other direct costs (equipment rental, analytical costs, telephone costs); $10,000 for preparation of a treatability report based on jar testing and analyses; and $5,000 for miscellaneous expenses. For the purpose of estimating costs for sites with chemical precipitation systems that do not achieve model treatment performance, EPA also assumed an additional annual cost equal to 15 percent of sites' existing annual costs to account for design and operational modifications to polymer feed and pH control systems. EPA did not develop more detailed cost estimates for these instances because these refinements would not impact the Agency's final action for the steel finishing subcategory.

For the steel finishing subcategory, EPA also estimated one-time costs associated with lost revenue for down time during installation of countercurrent rinse tanks for steel finishing lines. Based on industry comments, the Agency assumed lost line revenue of approximately $900,000 per line. This estimate is based on a down time of 21 days for tank installation, an average of $448/ton of cold rolled coil sheet steel, and a median production rate of 95 tons/day per line (Reference 10-6).

For technology options incorporating high-rate recycle in the ironmaking, integrated steelmaking, integrated and stand-alone hot forming, and non-integrated steelmaking and hot forming subcategories, EPA evaluated PNFs and recycle technology in place to determine whether a site required investment and operating and maintenance costs for flow reduction to achieve the model effluent pollutant loadings. The Agency found several instances where facilities have installed high-rate recycle systems, but the discharge flow rates exceeded the model PNFs. If the system was equipped with excess capacity to recirculate the incremental flow necessary to achieve the model PNF, EPA did not assign an investment cost for new equipment in the main treatment and recycle circuit. In cases where the increase in recycle rate was minimal with respect to the total recirculating flow rate, EPA assigned a one-time cost for consultant and mill services to evaluate the treatment and recycle system and to modify water management practices and operations to achieve the model PNF. If the treatment and recycle system lacked sufficient hydraulic capacity to recirculate the incremental flow necessary to achieve the model discharge flow rate, EPA sized and costed additional process water treatment and recycle equipment for the main treatment and recycle circuit.

The Agency assumed that the one-time costs for flow reduction would include relatively minor costs associated with controlling makeup water flow rates and eliminating sources of extraneous water and did not assign incremental operation and maintenance costs. The Agency assumed the increased costs associated with modifying the recycle rate would be minimal and offset by likely savings in process water chemical treatment. In addition, EPA assumed one-time costs for minimal improvements in wastewater treatment performance or recycle rates to be $50,000. This estimate is based on a 10-week study, comprising 400 hours of direct labor (160 hours of field work and 240 hours of office work) at a labor rate of $100 per hour; approximately $5,000 for airfare, food, lodging, car rental, and other direct costs (equipment rental, analytical costs, telephone costs); and $5,000 for miscellaneous expenses. EPA did not develop more detailed cost estimates for these instances because these refinements would not impact the Agency's final action for the subcategories with high-rate recycle as a component of a technology option.

10.2 Results

This section presents EPA's national estimates of incremental investment and operating and maintenance costs by technology option for each industry subcategory. Agency cost estimates for this rulemaking are factored estimates and are believed to be accurate within ±25 to ±30 percent (Reference 10-3). Site-specific cost estimates are documented by subcategory in Section 14.6 of the Administrative Record: by-product recovery cokemaking (DCN IS10721), sintering (DCN IS10705), ironmaking (DCN IS10717), integrated steelmaking (IS10694), integrated and stand-alone hot forming (DCN IS10830), non-integrated steelmaking and hot forming (DCN IS10697), steel finishing (DCN IS10702), and other operations (DCN IS10706).

10.2.1 Cokemaking Subcategory - By-Product Recovery and Non-Recovery Segments

The Agency estimated the cost impacts for a total of four BAT and PSES technology options for 20 by-product recovery cokemaking sites in the United States that discharge wastewater. Of these 20 sites, 12 are direct dischargers and 8 are indirect dischargers. The table below summarizes the technology options evaluated after proposal. To incorporate comments submitted in response to the proposed rule, EPA revised cost estimates associated with the BAT-1, BAT-3, PSES-1, and PSES-3 technology options to account for costs associated with installing free and fixed ammonia distillation systems and minimizing and reducing extraneous flows, when applicable. The Agency revised cost estimates for BAT-3 to incorporate costs to install and operate multimedia filtration following breakpoint chlorination, which is consistent with the treatment configuration of the site operating this technology. EPA did not further consider technology options BAT-2, BAT-4, PSES-2, and PSES-4 after proposal, as discussed in Section 9. Therefore, the Agency did not revise cost estimates for these options and cost estimates for options BAT-1, BAT-3, PSES-1, and PSES-3 are presented in Table 10-17.

Technology Options for By-Product Recovery Segment

Treatment Unit	BAT-1	BAT-3	PSES-1	PSES-3
Tar/oil removal	✔	✔	✔	✔
Equalization/ammonia still feed tank	✔	✔	✔	✔
Free and fixed ammonia still	✔	✔	✔	✔
Temperature control	✔	✔		✔
Equalization tank	✔	✔	✔	✔

Treatment Unit	BAT-1	BAT-3	PSES-1	PSES-3
Biological treatment with secondary clarification	✔	✔		✔
Sludge dewatering	✔	✔		✔
Breakpoint chlorination (2-stage)		✔		
Multimedia filtration		✔		

BAT-1

EPA analyzed long-term average effluent data, treatment system flow rates, and wastewater treatment operating parameters provided in industry survey responses from all 13 direct dischargers. The Agency estimated that:

- One site would install additional aeration capacity for biological treatment in order to achieve the model treatment concentration for ammonia as nitrogen. Based on operating and design parameters reported by this site, the Agency concluded that the current operating hydraulic retention time (HRT) and solids retention time (SRT) at this site are insufficient to consistently achieve the model pollutant loadings. Consequently, the Agency estimated investment costs for additional biological treatment basin capacity required to achieve a 50-hour HRT and an SRT of 100 days, which are based on industry survey responses from by-product recovery cokemaking sites with model treatment and performance. EPA also estimated that this site would replace an existing free and fixed ammonia distillation system and install an equalization tank ahead of the ammonia stills to minimize influent and effluent variability for ammonia as nitrogen.

- Three sites would upgrade and optimize existing biological treatment systems.

- One site would install a free ammonia distillation system.

- Two sites would install additional biological treatment filters and operate existing ammonia stills at a lower operating pH, possibly requiring relocation of the sodium hydroxide injection point.

- One site would upgrade and optimize an existing biological treatment system, reroute benzol plant wastewaters to an existing equalization tank, and install a free and fixed ammonia distillation system.

- One site would install a tar removal system, heat exchanger, biological treatment equalization tank, a final cooler to reduce noncontact cooling water to biological treatment, a new sewer to route only ammonia still effluent and control water to biological treatment, and a spare pump for coke quench water return to eliminate runoff to biological treatment in the event of primary pump failure or maintenance. This site would also upgrade controls on an existing ammonia distillation system, increase the frequency of biological treatment monitoring, and replace a boiler water preheater to eliminate a leak of boiler water to the process water collection system.

- One site would install biological treatment equalization tanks.

- One site does not operate biological treatment following ammonia distillation. Instead, this site operates an ammonia still followed by a dephenolization system, sand filtration, and granular activated carbon filtration. The Agency assumed that this site would install an ammonia distillation equalization tank and biological treatment equalization tank, demolish an old blast furnace area to accommodate installation of a biological treatment system to replace an existing physical chemical treatment system, and replace direct cooling of hot oil decanter with an indirect heat exchanger to reduce the discharge flow rate. Although these improvements would require a significant investment, the Agency estimated that this site would realize annual operating and maintenance cost savings.

- Two sites would not incur any costs.

BAT-3

In addition to the costs associated with BAT-1, EPA estimated that all 13 direct dischargers would install breakpoint chlorination systems in order to achieve BAT-3 model effluent pollutant loadings. The Agency estimated that nine of these sites would also install multimedia filtration systems. EPA revised cost estimates associated with breakpoint chlorination systems to incorporate comments submitted in response to the proposed rule. EPA included costs for a sodium hypochlorite delivery and feed system, as well as costs to comply with Uniform Fire Code standards, to account for safety considerations of chlorination systems. The Agency also incorporated additional costs for insulation, heat tracing, air dryers, an extra 200 feet of piping, a sodium bisulfite storage tank, and software for process control and instrumentation. Table 10-5 presents the revised cost estimates.

PSES-1

Of the eight indirect dischargers, two use ammonia stills followed by biological treatment (conventional activated sludge systems) and one uses biological treatment (sequencing batch reactors) followed by air stripping. Two sites operate an ammonia still followed by cyanide precipitation; one of these sites also operates a sand filtration system following cyanide precipitation. The remaining three sites operate an ammonia still. Two of the eight sites discharge to POTWs with nitrification capability and would therefore qualify for a waiver for ammonia as nitrogen limits. The Agency estimated that:

- One site would install an equalization tank following an existing ammonia distillation system and incur costs for additional steam and caustic;

- One site would incur costs to minimize non-process wastewater infiltration and wastewater generated from crude light oil recovery operations;

- One site would install an equalization tank and a free and fixed ammonia distillation system;

- One site would install an equalization tank prior to an existing ammonia distillation system and incur costs to eliminate non-process water infiltration;

- One site would install equalization tanks prior to and after ammonia stills and incur costs for additional steam and caustic;

- One site would optimize and upgrade an existing biological treatment system instead of installing a new ammonia distillation system to reduce effluent ammonia loadings; and

- Two sites would not incur any costs.

PSES-3

The Agency estimated that five sites would install biological treatment systems in order to comply with PSES-3. The Agency estimated investment costs of installing biological treatment systems designed and operated based on a 50-hour HRT and an SRT of 100 days, along with associated equalization, clarification and sludge handling systems. EPA also estimated that three sites with existing biological treatment would incur a one-time cost in order to improve system performance.

Non-Recovery Segment

The Agency is aware of one non-recovery cokemaking plant that operated in 1997. This site does not discharge process wastewater and would therefore not incur any costs in order to comply with this rule.

10.2.2 Ironmaking and Sintering Subcategories

Of the 20 integrated sites in the United States, 9 discharge only blast furnace wastewater and 3 discharge commingled blast furnace and sintering wastewater. The Agency is also aware of one stand-alone sinter plant that operated in 1997 and discharged wastewater. Of the 14 sites that discharge blast furnace or sinter plant wastewater, 9 operate dedicated blast furnace treatment systems (one is an indirect discharger), 3 operate combined sintering and blast furnace treatment systems, 1 cotreats wastewater from sintering, blast furnace, and other iron and steel manufacturing processes, and 1 operates a dedicated sinter plant treatment system.

EPA performed two separate costing analyses for the ironmaking and sintering subcategories. The first analysis was similar to that performed by EPA for the proposed rule, where sintering was a segment within the ironmaking subcategory. The second analysis was based on developing revised limitations within the existing regulatory structure, which includes sintering as a separate subcategory. These two analyses are described below.

Ironmaking Subcategory

The table below summarizes the technology options for treatment of blast furnace and sintering wastewater, whether cotreated or treated separately. The BAT-1 option consists of multimedia filtration to remove dioxin/furans and is discussed in Section 9.2. Under this option, sites would have to monitor for 2,3,7,8-tetrachlorodibenzofuran (TCDF) at a point prior to commingling with wastewater from any non-sintering or non-blast-furnace operations, with the exception that facilities may commingle ancillary non-blast-furnace wastewater (comprising 5 percent of total flow or less) with sintering wastewater. For the purpose of this analysis, EPA continued to use the proposed subcategorization in which ironmaking and sintering operations were combined into a single subcategory with different segments. Agency cost estimates for these options are discussed in the subsections below and presented in Table 10-18.

Technology Options for Ironmaking Subcategory

Treatment Unit	**BAT-1**	**PSES-1**
Clarifier	✔	✔
Sludge dewatering	✔	✔
Cooling tower (blast furnace only)	✔	✔
High-rate recycle	✔	✔
Blowdown treatment		
Metals precipitation	✔	✔
Breakpoint chlorination (2-stage)	✔	
Multimedia filtration	✔	

BAT-1/PSES-1

EPA evaluated industry survey responses from 13 direct dischargers and 1 indirect discharger. EPA revised cost estimates for these technology options to incorporate comments submitted in response to the proposed rule. The Agency determined necessary equipment modifications without assuming that facilities would reapply for and be granted 301(g) variances during permit renewal. EPA also revised cost estimates associated with breakpoint chlorination to incorporate costs for a sodium hypochlorite delivery and feed system as well as costs to comply with Uniform Fire Code standards to account for safety considerations of chlorination systems. The Agency also incorporated additional costs for insulation, heat tracing, air dryers, an extra 200 feet of piping, a sodium bisulfite storage tank, and software for process control and instrumentation. Table 10-9 presents the revised cost estimates for breakpoint chlorination. For the sites evaluated for options BAT-1 and PSES-1 (13 direct discharge sites were evaluated for BAT-1 and one indirect discharge site was evaluated for PSES-1), the Agency estimated that:

- Two sites with existing once-through treatment systems would install high-rate recycle systems to achieve the model PNF. In addition, EPA estimated that one of these sites would install a blowdown treatment system comprising metals precipitation, solids handling, breakpoint chlorination, and multimedia filtration, while the other site would install a blowdown treatment system comprising metals precipitation, solids handling, and multimedia filtration. To estimate the investment costs for high-rate recycle systems, the Agency used an engineering and design firm (independent of the electronic cost model) for each site.

- One site would install a blowdown multimedia filtration system.

- One site would install two breakpoint chlorination systems for two separate treatment systems and also incur one-time costs to increase recycle rates.

- One sites would incur a one-time cost to modify operating practices and incur additional annual operating and maintenance costs.

- Four sites would install a blowdown treatment system comprising metals precipitation, solids handling, breakpoint chlorination, and multimedia filtration; one of these sites would also install an additional cooling tower, piping, and pump station to increase recycle, while another of these sites would also incur a one-time cost to increase recycle.

- One site would install a blowdown treatment system comprising breakpoint chlorination and multimedia filtration.

- One site would install a blowdown treatment system comprising breakpoint chlorination and multimedia filtration and incur a one-time cost increase recycle.

- Two sites would install a blowdown treatment system comprising breakpoint chlorination and multimedia filtration and install an additional cooling tower, piping, and pump station to increase recycle.

Sintering Subcategory

For the sintering subcategory, EPA evaluated revising the current regulation to add limitations and standards for one additional pollutant, 2,3,7,8-TCDF, while keeping the rest of the limits unchanged. For this analysis, EPA considered a technology basis composed of multimedia filtration to remove chlorinated dioxin and furan congeners from sintering wastewater, prior to commingling sintering wastewater with wastewater from any non-sintering or non-blast-furnace operations (with the exception that facilities may commingle ancillary non-blast-furnace wastewater comprising 5 percent of the total flow or less). EPA evaluated industry survey responses from five direct dischargers; EPA identified no indirect discharging sintering facilities.

To incorporate comments submitted in response to the proposed rule, the Agency revised its cost estimates for multimedia filtration systems to include costs for insulation, heat tracing, an extra 200 feet of piping, and software for process control and instrumentation. Table 10-13 presents the revised costs for multimedia filtration systems. For this analysis, EPA estimates that four sites would install a multimedia filtration system and solids handling system and one site would install a chemical precipitation system, solids handling system, and multimedia filtration system.

10.2.3 Integrated Steelmaking Subcategory

According to industry survey responses, there are 20 integrated sites with basic oxygen furnaces (BOFs) and continuous casting operations. Thirteen of these sites have vacuum degassing operations. The Agency is also aware of one non-integrated site that operates a BOF. EPA estimated incremental costs for these 21 sites. The table below summarizes the technology options for control of treatment of wastewater from BOF, vacuum degassing, and continuous casting operations, whether cotreated or treated separately. Agency cost estimates for these options are discussed in the subsection below and presented in Table 10-19.

Technology Options for Integrated Steelmaking Subcategory

Treatment Unit	**BAT-1**	**PSES-1**
Classifier (BOF only)	✔	✔
Scale pit with oil skimming (continuous casting only)	✔	✔
Carbon dioxide injection (wet-suppressed and wet-open combustion BOFs only)	✔	✔
Clarifier	✔	✔
Sludge dewatering	✔	✔
Multimedia filtration (a) (continuous casting only)	✔	✔

Treatment Unit	**BAT-1**	**PSES-1**
Cooling tower (vacuum degassing and continuous casting)	✔	✔
High-rate recycle	✔	✔
Blowdown treatment		
Metals precipitation	✔	✔

(a) May be used in recycle circuit or as blowdown treatment.

BAT-1/PSES-1

The Agency estimated that 16 of the 21 sites would install a total of 25 blowdown metals precipitation systems to achieve BAT-1/PSES-1 model Pollutant loadings. Based on industry comments, EPA revised metals precipitation costs to include an equalization tank with a mixer, a rapid mix tank, a flocculation tank, conventional clarifiers, and software/process control costs in lieu of an equalization tank followed by a reactor clarifier with sodium hydroxide and polymer feed systems. EPA estimated that four treatment systems at four sites would not incur any costs.

In addition to the costs discussed above, the Agency estimated that:

- Seven sites would install a total of eight carbon dioxide injection systems to increase recycle rates for wet-suppressed or wet-open combustion BOF recycle systems;
- Three sites would install additional piping and pump stations to increase recycle rates of four recycle systems;
- Eight sites would install additional cooling towers, piping, and pump stations to increase recycle rates for nine recycle systems;
- Seven sites would incur one-time costs to increase recycle rates of seven recycle systems by an average of 1.5 percent;
- One site would install a high-rate recycle system to replace a once-through treatment system (the engineering and design firm prepared a cost estimate for this site independently of the cost model); and
- One site would incur costs to eliminate various noncontact cooling water leaks into existing treatment systems (the site provided a cost estimate).

Note that multiple cost items summarized above may apply to one site. Therefore, the sum of the sites from each bullet does not equal the total number of sites evaluated for this option.

10.2.4 Integrated and Stand-Alone Hot Forming Subcategory

The Agency estimated that 44 carbon steel integrated and stand-alone hot forming sites discharge wastewater to surface waters in the United States and 6 sites discharge wastewater to POTWs. EPA estimated that the three integrated and stand-alone hot forming sites that manufacture stainless steel products are indirect dischargers. No survey respondent with stainless steel hot forming operations reported directly discharging wastewater.

The table below summarizes the technology options evaluated for the carbon and alloy steel and stainless steel segments of this subcategory. Agency cost estimates for these options are discussed in the subsections below and presented in Table 10-20.

Technology Options for Integrated and Stand-Alone Hot Forming Subcategory

Treatment Unit	BAT-1	PSES-1
Scale pit with oil skimming	✔	✔
Roughing clarifier with oil removal	✔	✔
Sludge dewatering	✔	✔
Multimedia filtration (a)	✔	✔
High-rate recycle	✔	✔
Blowdown treatment		
Multimedia filtration (a)	✔	✔

(a) May be used in recycle circuit or as blowdown treatment.

BAT-1 (Carbon and Alloy Steel Segment)

The Agency estimated that 13 of the 44 sites would install a total of 14 high-rate recycle systems to replace existing partial recycle or once-through treatment systems. The Agency used an engineering and design firm to estimate investment costs (independently of the cost model) to install 12 high-rate recycle systems. One of these estimates included costs to segregate hot forming and finishing wastewater that was cotreated in an end-of-pipe system. The Agency distributed costs associated with this modification to the integrated and stand-alone hot forming subcategory and steel finishing subcategory according to the relative percentage of wastewater flow reported by this site from both subcategories. The Agency used cost estimates submitted in response to the proposed rule to estimate investment costs to install the other two high-rate recycle treatment systems.

In addition to the wastewater treatment modifications mentioned above, the Agency also estimated that:

- Six sites would install blowdown multimedia filtration systems;

- Seven sites would install blowdown multimedia filtration systems, cooling towers, pump stations, and piping;
- Three sites would install a total of five blowdown multimedia filtration systems and would incur one-time costs for flow reduction;
- Six sites would install cooling towers, pump stations, and piping; and
- Twelve treatment systems at a total of 12 sites would not incur any costs to comply with BAT-1.

Note that multiple cost items summarized above may apply to one site. Therefore, the sum of the sites from each bullet does not equal the total number of sites evaluated for this option. The Agency estimated that 12 of the sites mentioned above would install multimedia filtration systems to treat blowdown flow rates less than 50 gallons per minute (gpm). Based on vendor information obtained for small-scale multimedia filtration systems, the Agency estimated an investment cost of $200,000 would be required to purchase and install each of these systems.

PSES-1 (Carbon and Alloy Steel Segment)

Of the six indirect discharging carbon steel integrated and stand-alone hot forming sites, the Agency estimated that two sites would install blowdown filtration systems to treat flow rates less than 50 gpm and incur a one-time cost for flow reduction. EPA estimated that four sites would not incur any costs to comply with PSES-1.

PSES-1 (Stainless Steel Segment)

Of the three indirect discharging stainless steel sites, the Agency estimated that two sites would install blowdown filtration systems and one site would incur a one-time cost for flow reduction.

10.2.5 Non-Integrated Steelmaking and Hot Forming Subcategory

The Agency estimated that 40 carbon steel mini-mills discharge wastewater from vacuum degassing, continuous casting, or hot forming operations, whether cotreated or treated separately, to surface waters of the United States and 16 discharge wastewater from these operations to POTWs. The Agency also estimated that four stainless steel mini-mills discharge wastewater from vacuum degassing, continuous casting, or hot forming operations, whether cotreated or treated separately, to surface waters of the United States and five discharge wastewater from these operations to POTWs.

The table below summarizes the technology options evaluated for the carbon and alloy steel and stainless steel segments of this subcategory. Agency cost estimates for these options are discussed in the subsections below and presented in Table 10-21.

Technology Options for Non-Integrated Steelmaking and Hot Forming Subcategory

Treatment Unit	BAT-1	PSES-1
Scale pit with oil skimming (continuous casting and hot forming only)	✔	✔
Clarifier	✔	✔
Sludge dewatering	✔	✔
Cooling tower	✔	✔
Multimedia filtration (a)	✔	✔
High-rate recycle	✔	✔
Blowdown treatment		
Metals precipitation (a)		
Multimedia filtration (a)	✔	✔

(a) May be used in recycle circuit or as blowdown treatment.

BAT-1 (Carbon and Alloy Steel Segment)

The Agency estimated that two sites would replace existing once-through treatment systems with high-rate recycle systems. An engineering and design firm prepared cost estimates for these sites independently of the cost model. EPA also estimated that:

- Twelve sites would install a total of 17 blowdown multimedia filtration systems;
- Four sites would install blowdown multimedia filtration systems, cooling towers, pump stations, and piping and incur one-time costs;
- Two sites would install blowdown multimedia filtration systems and incur one-time costs for flow reduction;
- Eight sites would install cooling towers, pump stations, and piping for a total of 13 recycle systems;
- Four sites would install cooling towers, pump stations, and piping for a total of five recycle systems and incur one-time costs; and
- Thirteen sites would incur one-time costs for flow reduction at 22 recycle systems.

EPA estimated that all of the multimedia filtration systems mentioned above would treat less than 50 gpm of wastewater. The Agency believes that 14 treatment systems at a total of 13 sites would not incur any costs to comply with BAT-1. Note that multiple cost items summarized above may apply to one site. Therefore, the sum of the sites from each bullet does not equal the total number of sites evaluated for this option.

PSES-1 (Carbon and Alloy Steel Segment)

The Agency estimated that two sites would install a blowdown multimedia filtration system; one site would install a blowdown multimedia filtration system and a cooling tower, pump station, and piping and incur one-time costs; six sites would install blowdown multimedia filtration systems and incur one-time costs; and three sites would install cooling towers, pump stations, and piping. EPA estimated that seven of the multimedia filtration systems mentioned would treat less than 50 gpm of wastewater. The Agency believes that 11 treatment systems at a total of 10 sites would not incur any costs to comply with PSES-1. Note that multiple cost items summarized above may apply to one site. Therefore, the sum of the sites from each bullet does not equal the total number of sites evaluated for this option.

BAT-1 (Stainless Steel Segment)

EPA estimated that one site would replace an existing once-through treatment system with a high-rate recycle system. An engineering and design firm prepared a cost estimate for this site independently of the cost model. The Agency also estimated that one site would install separate two multimedia filtration systems to treat less than 50 gpm of wastewater and incur one-time costs, one site would incur one-time costs for flow reduction, and one site would not incur any costs to comply with BAT-1.

PSES-1 (Stainless Steel Segment)

The Agency estimated that one site would install two multimedia filtration systems at two separate treatment systems to treat less than 50 gpm of wastewater and incur one-time costs, two sites would install cooling towers, pump stations, and piping, and two sites would not incur any costs to comply with PSES-1.

10.2.6 Steel Finishing Subcategory

The Agency estimated that 51 carbon steel and 19 stainless steel finishing mills discharge wastewater to surface waters in the United States and 31 carbon steel and 14 stainless steel finishing mills discharge wastewater to POTWs.

The table below summarizes the technology options evaluated for the carbon and alloy steel and stainless steel segments. Comments submitted in response to the proposed rule provided information to the Agency on the efficiency and performance of acid purification technology, which indicated EPA substantially overestimated the capability of acid purification units (APUs) in the proposed rule. Therefore, EPA also estimated costs and pollutant removals without APUs as a component of the technology option. Estimates excluding APUs as a technology option component resulted in substantially higher costs with lower pollutant removals than those estimated at proposal.

Technology Options for Steel Finishing Subcategory

Treatment Unit	BAT-1	PSES-1
In-Process Controls		
Countercurrent rinses	✔	✔
Recycle of fume scrubber water	✔	✔
Wastewater Treatment		
Oil removal	✔	✔
Hydraulic and waste loading equalization	✔	✔
Hexavalent chromium reduction	✔	✔
Metals precipitation	✔	✔
Clarification	✔	✔
Sludge dewatering	✔	✔

The Agency evaluated PNFs from manufacturing lines at each site for comparison with model PNFs. For lines with PNFs within 25 percent of the model PNF, EPA allocated a one-time cost to sites to achieve model PNFs. The Agency assumed relatively minor costs are associated with controlling rinse water flow rates to achieve these flow reductions and would be included in the one-time cost.

For manufacturing lines with PNFs greater than 25 percent, the Agency estimated costs to install countercurrent rinse tanks at $150,000 per line. This estimate is based on installation of an additional 10,000-gallon rinse tank with associated pumps and blowers for bath agitation. Furthermore, EPA did not assign incremental operating and maintenance costs for installation of countercurrent rinse tanks. The Agency assumed that operating and maintenance costs incurred because of installation of these tanks would be minimal and offset by likely savings in rinse water usage and process water chemical treatment. Comments submitted in response to the proposed rule indicated that these costs would vary greatly with each site, depending on the presence of adequate space on process lines for additional tanks, and that down time associated with such process modifications would be significantly more that EPA estimated at proposal. In response to this comment, EPA revised its cost estimates associated with the installation of countercurrent rinse tanks to include a one-time cost of $900,000 per line for lost line revenue.

EPA did not modify the methodology discussed above further because these modifications would not impact the Agency's final action for the steel finishing subcategory. In response to comments received on the proposed rule regarding infeasibility of model PNFs because of product quality concerns, EPA did evaluate possible concentration-based effluent limitations for this subcategory. However, pollutant removals associated with this evaluation were too small to justify the projected costs. Agency cost estimates for the evaluated technology options, except for the consideration of concentration-based limitations, are discussed in the subsections below and presented in Table 10-22.

BAT-1 (Carbon and Alloy Steel Segment)

Based on industry survey responses, EPA estimated that six sites would incur a one-time cost to optimize existing metals precipitation systems. The Agency assumed a 15-percent increase in annual operating and maintenance costs for these sites. EPA estimated that four sites would require wastewater treatment modifications and incur flow reduction costs. The Agency also costed one site to segregate hot forming and finishing wastewater that was cotreated in an end-of-pipe system. The Agency used an engineering and design firm to estimate this cost. This estimate was prepared independently of the cost model. EPA distributed costs associated with this modification to the integrated and stand-alone hot forming subcategory and steel finishing subcategory according to the relative percentage of wastewater flow reported by this site from both subcategories.

In addition to the in-process control and wastewater treatment modifications mentioned above, the Agency also estimated that:

- Three sites would install countercurrent rinse tanks on a single line;
- Seven sites would install countercurrent rinse tanks and incur a one-time cost for flow reduction;
- Nine would incur one-time costs to achieve model PNFs; and
- Twenty-one sites would not incur any costs to comply with BAT-1.

PSES-1 (Carbon and Alloy Steel Segment)

The Agency estimated that six sites would require wastewater treatment modifications to achieve model effluent pollutant loadings. EPA estimated costs for five of these sites to install metals precipitation systems, clarifiers, and associated sludge handling systems and for the other site to install a clarifier.

In addition to the wastewater treatment modifications mentioned above, the Agency also estimated that:

- Five sites would incur a one-time cost for flow reduction on a single line;

- Two sites would install a countercurrent rinse tank on a single line;
- One site would install a countercurrent rinse tank on a single line, incur a one-time cost, and incur a 15-percent increase in annual operating and maintenance costs to optimize existing metals precipitation systems;
- One site would install countercurrent rinse tanks on multiple lines; and
- Sixteen sites would not incur costs to comply with PSES-1.

BAT-1 (Stainless Steel Segment)

The Agency estimated that two sites would incur a one-time cost for flow reduction for a single line. In addition to these in-process modifications, the Agency also estimated that:

- Six sites would install countercurrent rinse tanks on multiple lines and incur a one-time cost for flow reduction;
- Eight sites would install countercurrent rinse tanks on multiple lines and incur a one-time cost and a 15-percent increase in annual operating and maintenance costs to optimize existing metals precipitation systems; and
- Three sites would not incur costs to comply with BAT-1.

PSES-1 (Stainless Steel Segment)

The Agency estimated that three sites would incur one-time costs, a 15-percent increase in annual operating and maintenance costs to optimize existing metals precipitation systems, and additional costs for flow reduction. In addition, the Agency estimates that:

- Two sites would incur a one-time cost and a 15-percent increase in annual operating and maintenance costs to optimize existing metals precipitation systems;
- One site would incur one-time costs for flow reduction; and
- Eight sites would not incur costs to comply with PSES-1.

10.2.7 Other Operations Subcategory

Direct-Reduced Ironmaking (DRI) Segment

The table below presents the BPT technology option evaluated for this segment. EPA is not discussing or presenting cost estimates because data aggregation or other masking techniques are insufficient to protect confidential business information. The Agency evaluated effluent total suspended solids concentrations reported by sites, PNFs, and technology in place to determine appropriate costs to achieve model pollutant loadings.

Technology Options for DRI Segment

Treatment Unit	BPT
Classifier	✔
Clarifier	✔
Sludge dewatering	✔
Cooling tower	✔
High-rate recycle	✔
Blowdown treatment	
Multimedia filtration	✔

Forging Segment

Of the eight direct discharging forging operations and four indirect discharging forging operations, the Agency estimated that two sites would install a blowdown multimedia filtration system and incur a one-time cost to achieve the model loadings and two sites would install a blowdown multimedia filtration system. The Agency also estimated that four sites would not incur costs to comply with BPT. EPA assigned a one-time cost of $20,000 for consultant and mill services to evaluate how to modify contact water management practices to achieve the model PNF for forging. Forging operations at iron and steel sites are small-scale operations that range in production from 500 to 90,000 tons of steel per year. Sites estimated to incur a one-time cost forge well below 20,000 tons of steel per year. Consequently, the Agency's estimate is based on a short-term study, consisting of 150 hours of direct labor (50 hours of field work and 100 hours of office work) at a labor rate of $100 per hour. The Agency also estimated approximately $2,500 for airfare, food, lodging, and other direct costs (equipment rental, analytical costs, telephone costs) and $2,500 for miscellaneous expenses. Table 10-23 presents Agency cost estimates for the BPT option.

Technology Options for Forging Segment

Treatment Unit	BPT
High-rate recycle	✔
Blowdown treatment	
Oil/water separator	✔
Multimedia filtration	✔

Briquetting Segment

The Agency is aware of four sites with briquetting operations active in 1997. These sites do not discharge process wastewater and would therefore not incur any costs in order to comply with this rule.

10.3 References

10-1 U.S. Environmental Protection Agency. Economic Analysis of the Final Effluent Limitations Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category. EPA 821-R-02-006, Washington, DC, April 2002.

10-2 U.S. Department of Labor, Monthly Labor Review. Washington, DC, 1997.

10-3 Perry, R. and Green, D. Perry's Chemical Engineer's Handbook, Sixth Edition. McGraw-Hill, Inc., 1984.

10-4 Chemical Market Reporter. Schnell Publishing Company, December 1997.

10-5 U.S. Department of Energy. Electric Power Annual 1998. Volume I. Washington, DC, 1998.

10-6 U.S. Department of Commerce. Current Industrial Reports, Steel Mill Products - 1997. MA33B, September 1998.

Table 10-1

Assumptions Used to Develop Cost Estimates in Tables 10-2 through 10-13

Category	Assumption
Spatial limitations	Additions to the wastewater treatment system will be located within 500 feet of the existing system.
	An approximate length of 500 feet is used for the supply of water to the new water treatment facility.
	Equipment is located so that the length between processing tanks, sumps, and processing equipment will be within 20 feet.
	Outfalls or sewers leading to outfalls are located within 300 feet of the exit of the new water treatment facility.
	Motors are located within 150 feet from motor control center, 160 feet of conduit per motor, 260 feet of control cable per motor.
Solids handling	Sludge or filter backwash generated from add-on treatment systems will be thickened and dewatered with existing equipment in existing high-rate recycle systems, except for blast furnace and sintering operations, where separate sludge dewatering facilities were costed for blowdown treatment systems to segregate high zinc-content sludges from wastewater sludges that may be recycled to the blast furnaces.
Civil/structural costs	Site preparation is minimal; no major demolition, excavation of existing foundations or movement of railroad tracks.
	Soil conditions are such that no piles are required.
	No excavation of hazardous materials.
Piping/installation	Blended labor rate of $60 per hour, consistent with union labor rates, for personnel performing equipment installation.
	1,000 feet of 2-inch carbon steel pipe has been included for plant air distribution. There is no allowance for an air compressor.
	Pipe has been sized to keep the water velocity less than 8 feet per second.
	2-inch nominal piping and under is priced as schedule 80 threaded carbon steel.
	Pipe over 2 inches is priced as standard schedule carbon steel pipe with welded joints.
	316 stainless steel pipe is used for chlorine, caustic, and acid piping.
	Costs for supports and painting are included.
	10% of the total cost allowed for manual valves.
Electrical/process control instrumentation	5% of the total cost allowed for instrumentation.
	Electrical and other utility services are available at the site.

Table 10-2

Design Specifications for Cokemaking Granular Activated Carbon Model Treatment Systems

Item	Type	100,000 gpd		400,000 gpd		2,700,000 gpd	
		Number	Size	Number	Size	Number	Size
Pump station 1	Vertical turbine	2 pumps	1.5 HP	2 pumps	7.5 HP	2 pumps	40 HP
Pump station 2	Vertical turbine	2 pumps	1/3 HP	2 pumps	1/3 HP	2 pumps	2 HP
Filter backwash pump	Vertical turbine	2 pumps	5 HP	2 pumps	5 HP	2 pumps	2 BHP
Equalization basin	Concrete	1	3,500 ft^3	1	13,500 ft^3	1	90,000 ft^3
Sump 1	Concrete	1	450 ft^3	1	700 ft^3	1	4,000 ft^3
Backwash surge basin	Concrete	1	450 ft^3	1	700 ft^3	1	4,000 ft^3
Activated carbon system	Filters	2	4' × 3'/ 7.5 HP	2	7' × 7'/ 7.5 HP	3	15' × 10/ 20 HP

Table 10-3

Estimated Investment Costs for Cokemaking Granular Activated Carbon Model Treatment Systems (100,000 - 2,700,000 gpd)

100,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Activated carbon system	2	$80,000	$160,000
	Activated carbon	1	$5,000	$5,000
	Pump station 1	2	$1,100	$2,200
	Pump station 2	2	$2,500	$5,000
	Filter backwash pumps	2	$3,000	$6,000
	Total freight			**$5,300**
	Subtotal			**$183,500**
Installation	**Mechanical equipment installation**			
	Activated carbon system	2	$11,000	$22,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$1,500	$3,000
	Filter backwash pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$58,000	$58,000
	Control valves/instrumentation	1	$10,200	$10,200
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Activated carbon system	1	$27,400	$27,400
	Equalization basin	1	$66,600	$66,600
	Sump 1	1	$19,000	$19,000
	Backwash surge basin	1	$19,000	$19,000

Table 10-3 (continued)

100,000 gpd				
Installation (cont.)	**Equipment structural support**			
	Pump station 1 platform	1	$4,000	$4,000
	Pump station 2 platform	1	$2,000	$2,000
	Filter backwash pumps	1	$8,000	$8,000
	Buildings			
	Activated carbon system	1	$21,000	$21,000
	Electrical and process control			
	Power/equipment	1	$48,100	$48,100
	Control/instrumentation	1	$40,600	$40,600
	Building services	1	$4,400	$4,400
	Subtotal			**$360,300**
Indirect costs	Temporary facilities (1%)			$5,400
	Spare parts (1.5%)			$8,200
	Engineering procurement and contract management (12%)			$65,300
	Commissioning (3%)			$16,300
	Owner team (10%)			$54,400
	Subtotal			**$149,600**
Total costs	Total direct and indirect costs			$693,400
	Contingency (20%)			$138,700
	Total Project Cost			**$832,100**

400,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Activated carbon system	2	$90,000	$180,000
	Activated carbon	1	$15,000	$15,000
	Pump station 1	2	$6,400	$12,800
	Pump station 2	2	$1,100	$2,200
	Filter backwash pumps	2	$6,500	$13,000
	Total freight			$6,700
	Subtotal			**$229,700**

Table 10-3 (continued)

400,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation	Mechanical equipment installation			
	Activated carbon system	2	$12,000	$24,000
	Pump station 1	2	$2,000	$4,000
	Pump station 2	2	$1,500	$3,000
	Filter backwash pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$91,100	$91,100
	Control valves/instrumentation	1	$16,100	$16,100
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Activated carbon system	1	$35,000	$35,000
	Equalization basin	1	$152,300	$152,300
	Sump 1	1	$22,000	$22,000
	Backwash surge basin	1	$22,000	$22,000
	Equipment structural support			
	Pump station 1 platform	1	$8,000	$8,000
	Pump station 2 platform	1	$2,000	$2,000
	Filter backwash pumps	1	$8,000	$8,000
	Buildings			
	Activated carbon system	1	$28,000	$28,000
	Electrical and process control			
	Power/equipment	1	$48,100	$48,100
	Control/instrumentation	1	$40,600	$40,600
	Building services	1	$5,800	$5,800
	Subtotal			**$514,000**
Indirect costs	Temporary facilities (1%)			$7,400
	Spare parts (1.5%)			$11,200
	Engineering procurement and contract management (12%)			$89,200
	Commissioning (3%)			$22,300
	Owner team (10%)			$74,400
	Subtotal			**$204,500**

Table 10-3 (continued)

400,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Total costs	Total direct and indirect costs			$948,200
	Contingency (20%)			$189,600
	Total Project Cost			**$1,137,800**

2,700,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Activated carbon system	3	$86,000	$258,000
	Activated carbon	1	$100,000	$100,000
	Pump station 1	2	$10,600	$21,200
	Pump station 2	2	$3,000	$6,000
	Filter backwash pumps	2	$1,500	$3,000
	Total freight			$11,600
	Subtotal			**$399,800**
Installation	**Mechanical equipment installation**			
	Activated carbon system	3	$12,000	$36,000
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$2,000	$4,000
	Filter backwash pumps	2	$1,500	$3,000
	Piping installation			
	Piping/supports	1	$175,400	$175,400
	Control valves/instrumentation	1	$31,000	$31,000
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Activated carbon system	1	$60,100	$60,100
	Equalization basin	1	$657,400	$657,400
	Sump 1	1	$59,100	$59,100
	Backwash surge basin	1	$59,100	$59,100
	Equipment structural support			
	Pump station 1 platform	1	$12,000	$12,000
	Pump station 2 platform	1	$12,000	$12,000
	Filter backwash pumps	1	$4,000	$4,000
	Buildings			
	Activated carbon system	1	$54,000	$54,000

Table 10-3 (continued)

2,700,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Electrical and process control**			
	Power/equipment	1	$82,500	$82,500
	Control/instrumentation	1	$44,400	$44,400
	Building services	1	$11,300	$11,300
	Subtotal			**$1,310,300**
Indirect costs	Temporary facilities (1%)			$17,100
	Spare parts (1.5%)			$25,700
	Engineering procurement and contract management (12%)			$205,200
	Commissioning (3%)			$51,300
	Owner team (10%)			$171,000
	Subtotal			**$470,300**
Total costs	Total direct and indirect costs			$2,180,400
	Contingency (20%)			$436,100
	Total Project Cost			**$2,616,500**

Table 10-4

Design Specifications for Cokemaking Breakpoint Chlorination Model Treatment Systems

		100,000 gpd		400,000 gpd		2,700,000 gpd	
Item	**Type**	**Number**	**Size**	**Number**	**Size**	**Number**	**Size**
Pump station 1	Vertical turbine	2 pumps	1/2 HP	2 pumps	1.5 HP	2 pumps	10 HP
Pump station 2	Vertical turbine	2 pumps	1/2 HP	2 pumps	3 HP	2 pumps	15 BHP
Pump station 3	Vertical turbine	2 pumps	1/2 HP	2 pumps	2 HP	2 pumps	15 HP
Pump station 4	Vertical turbine	2 pumps	1/2 HP	2 pumps	2 HP	2 pumps	15 HP
Pump station 5	Vertical turbine	2 pumps	1.5 HP	2 pumps	5 HP	2 pumps	30 BHP
pH adjust pump	Diaphragm	2	3 HP	2	3 HP	2	3 HP
Clarifier pump	Progressive capacity	2	3 HP	2	3 HP	2	5 BHP
NaOH pump 1	Diaphragm/ANSI	2	2 HP (diaphragm)	2	2 HP (ANSI)	2	2 HP (ANSI)
NaOH pump 2	Diaphragm	2	3 HP	2	3 HP	2	3 HP
Equalization basin	Concrete	1	4,000 ft^3	1	13,500 ft^3	1	90,000 ft^3
Reactor clarifier	Mild steel	1	12' diameter × 12' side	1	22 ft diameter × 12 ft side	1	60' diam.
Chlorination mixing tank	Concrete/lined	1	10 ft × 10 ft × 5 ft/ 5 HP	1	20 ft × 10 ft × 10 ft/ 15 HP	2	25 ft × 20 ft × 13 ft/2 @ 20 HP
Chlorination system	Building	1	10 ft × 9 ft × 20 ft/ 3 HP	1	10 ft × 9 ft × 20 ft/ 3 HP	1	15 ft × 20 ft × 20 ft/ 2 @ 3 HP
Retention tank	Concrete/lined	1	50 ft × 10 ft × 10 ft	1	50 ft × 20 ft × 20 ft	1	100 ft × 50 ft × 25 ft
Dechlorination tank	Concrete/lined	1	10 ft × 10 ft × 5 ft/ 5 HP	1	20 ft × 10 ft × 10 ft/ 15 HP	2	25 ft × 20 ft × 13 ft/ 2 @ 20 HP
Dechlorination system	Building/tank pad	1	8 ft × 8 ft × 15 ft/ 10 ft × 10 ft	1	8 ft × 8 ft × 15 ft/ 10 ft × 10 ft	1	8 ft × 8 ft × 15 ft/ 10 ft × 10 ft
NaOH tank 1	Carbon steel	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side	2	10' diameter × 10' side

FRP - Fiberglass, reinforced plastic.
ANSI - American National Standards Institute.

Table 10-5

Estimated Investment Costs for Cokemaking Breakpoint Chlorination Model Treatment Systems (100,000 - 2,700,000 gpd)

100,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Reactor clarifier	1	$40,000	$40,000
	Chlorination/dechlorination mixing systems	1	$33,200	$33,200
	NaOH tanks	2	$10,000	$20,000
	Pump station 1	2	$1,000	$2,000
	Pump station 2	2	$1,000	$2,000
	Pump station 3	2	$1,000	$2,000
	Pump station 4	2	$1,000	$2,000
	Pump station 5	2	$1,100	$2,200
	pH adjust pumps	2	$2,200	$4,400
	Clarifier pumps	2	$3,500	$7,000
	NaOH pumps 1	2	$3,500	$7,000
	NaOH pumps 2	2	$2,200	$4,400
	Total freight			**$3,800**
	Subtotal			**$130,000**
Installation	**Mechanical equipment installation**			
	Reactor clarifier	1	$100,000	$100,000
	Chlorination/dechlorination mixing systems	1	$10,000	$10,000
	NaOH tanks	2	$1,000	$2,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$1,500	$3,000
	Pump station 3	2	$1,500	$3,000
	Pump station 4	2	$1,500	$3,000
	Pump station 5	2	$1,500	$3,000
	pH adjust pumps	2	$2,000	$4,000
	Clarifier pumps	2	$2,000	$4,000
	NaOH pumps 1	2	$2,000	$4,000
	NaOH pumps 2	2	$2,000	$4,000

Table 10-5 (continued)

100,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Piping installation**			
	Piping/supports	1	$70,500	$70,500
	Insulation and heat tracing	1	$123,400	$123,400
	Control valves/instrumentation	1	$18,100	$18,100
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Reactor clarifier/ clarifier pumps	1	$8,800	$8,800
	NaOH pumps	2	$3,500	$7,000
	NaOH tanks	1	$4,200	$4,200
	Chlorination mixing tank	1	$20,500	$20,500
	Chlorination system	1	$12,600	$12,600
	Retention tank	1	$110,800	$110,800
	Dechlorination mixing tank	1	$20,500	$20,500
	Dechlorination system	1	$12,500	$12,500
	pH adjust pumps	1	$3,500	$3,500
	Equalization basin	1	$59,100	$59,100
	Equipment structural support			
	Pump station 1 platform	1	$4,000	$4,000
	Pump station 2 platform	1	$4,000	$4,000
	Pump station 3 platform	1	$4,000	$4,000
	Pump station 4 platform	1	$4,000	$4,000
	Pump station 5 platform	1	$4,000	$4,000
	Buildings			
	Chlorination system	1	$2,000	$2,000
	Dechlorination system	1	$2,000	$2,000
	Electrical and process control			
	Power/equipment	1	$99,400	$99,400
	Control/instrumentation	1	$90,300	$90,300
	UFC compliance costs	1	$250,600	$250,600
	Building Services (includes sodium hypochlorite storage and delivery costs)	1	$3,900	$3,900
	Subtotal			**$1,082,500**

Table 10-5 (continued)

100,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$12,100
	Spare parts (1.5%)			$18,200
	Engineering procurement and contract management (12%)			$145,400
	Commissioning (3%)			$36,400
	Owner team (10%)			$121,200
	Subtotal			**$333,300**
Total costs	Total direct and indirect costs			$1,545,200
	Contingency (20%)			$309,000
	Total Project Cost			**$1,854,200**

400,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Reactor clarifier	1	$52,000	$52,000
	Chlorination/dechlorination mixing systems	1	$118,800	$118,800
	NaOH tanks	2	$10,000	$20,000
	Pump station 1	2	$5,000	$10,000
	Pump station 2	2	$5,000	$10,000
	Pump station 3	2	$5,000	$10,000
	Pump station 4	2	$5,000	$10,000
	Pump station 5	2	$5,100	$10,200
	pH adjust pumps	2	$2,200	$4,400
	Clarifier pumps	2	$3,500	$7,000
	NaOH pumps 1	2	$5,000	$10,000
	NaOH pumps 2	2	$2,200	$4,400
	Total freight			**$8,000**
	Subtotal			**$274,800**

Table 10-5 (continued)

400,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation	**Mechanical equipment installation**			
	Reactor clarifier	1	$105,000	$105,000
	Chlorination/dechlorination mixing systems	1	$35,600	$35,600
	NaOH tanks	2	$1,000	$2,000
	Pump station 1	2	$2,000	$4,000
	Pump station 2	2	$2,000	$4,000
	Pump station 3	2	$2,000	$4,000
	Pump station 4	2	$2,000	$4,000
	Pump station 5	2	$2,000	$4,000
	pH adjust pumps	2	$2,000	$4,000
	Clarifier pumps	2	$2,000	$4,000
	NaOH pumps 1	2	$1,500	$3,000
	NaOH pumps 2	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$123,900	$123,900
	Insulation and heat tracing	1	$128,800	$128,800
	Control valves/instrumentation	1	$25,400	$25,400
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Reactor clarifier/clarifier pumps	1	$19,300	$19,300
	NaOH pumps	2	$3,500	$7,000
	NaOH tanks	1	$4,200	$4,200
	Chlorination mixing tank	1	$41,000	$41,000
	Chlorination system	1	$12,900	$12,900
	Retention tank	1	$221,600	$221,600
	Dechlorination mixing tank	1	$41,000	$41,000
	Dechlorination system	1	$12,900	$12,900
	pH adjust pumps	1	$3,500	$3,500
	Equalization basin	1	$175,500	$175,500

Table 10-5 (continued)

400,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Equipment structural support**			
	Pump station 1 platform	1	$6,000	$6,000
	Pump station 2 platform	1	$8,000	$8,000
	Pump station 3 platform	1	$6,000	$6,000
	Pump station 4 platform	1	$6,000	$6,000
	Pump station 5 platform	1	$12,000	$12,000
	Buildings			
	Chlorination system	1	$2,000	$2,000
	Dechlorination system	1	$2,000	$2,000
	Electrical and process control			
	Power/equipment	1	$99,500	$99,500
	Control/instrumentation	1	$90,300	$90,300
	UFC compliance costs	1	$250,600	$250,600
	Building Services (includes sodium hypochlorite storage and delivery costs)	1	$4,700	$4,700
	Subtotal			**$1,774,500**
Indirect costs	Temporary facilities (1%)			$17,700
	Spare parts (1.5%)			$26,600
	Engineering procurement and contract management (12%)			$212,900
	Commissioning (3%)			$53,200
	Owner team (10%)			$177,500
	Subtotal			**$488,000**
Total costs	Total direct and indirect costs			$2,262,500
	Contingency (20%)			$452,500
	Total Project Cost			**$2,715,100**

Table 10-5 (continued)

2,700,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Reactor clarifier	1	$155,000	$155,000
	Chlorination/dechlorination mixing systems	1	$798,000	$798,000
	NaOH tanks	2	$10,000	$20,000
	Pump station 1	2	$9,000	$18,000
	Pump station 2	2	$10,500	$21,000
	Pump station 3	2	$10,500	$21,000
	Pump station 4	2	$10,500	$21,000
	Pump station 5	2	$11,000	$22,000
	pH adjust pumps	2	$2,200	$4,400
	Clarifier pumps	2	$5,500	$11,000
	NaOH pumps 1	2	$8,500	$17,000
	NaOH pumps 2	2	$3,500	$7,000
	Total freight			**$33,500**
	Subtotal			**$1,148,900**
Installation	**Mechanical equipment installation**			
	Reactor clarifier	1	$300,000	$300,000
	Chlorination/dechlorination mixing systems	1	$239,400	$239,400
	NaOH tanks	2	$1,000	$2,000
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$2,500	$5,000
	Pump station 3	2	$2,500	$5,000
	Pump station 4	2	$2,500	$5,000
	Pump station 5	2	$2,500	$5,000
	pH adjust pumps	2	$2,000	$4,000
	Clarifier pumps	2	$2,000	$4,000
	NaOH pumps 1	2	$2,000	$4,000
	NaOH pumps 2	2	$2,000	$4,000

Table 10-5 (continued)

2,700,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Piping installation**			
	Piping/supports	1	$226,200	$226,200
	Insulation and heat tracing	1	$142,400	$142,400
	Control valves/instrumentation	1	$40,200	$40,200
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Reactor clarifier/clarifier pumps	1	$78,800	$78,800
	NaOH pumps	2	$3,500	$7,000
	NaOH tanks	1	$5,300	$5,300
	Chlorination mixing tank	2	$97,400	$194,800
	Chlorination system	1	$32,800	$32,800
	Retention tank	1	$1,000,800	$1,000,800
	Dechlorination mixing tank	2	$97,400	$194,800
	Dechlorination system	1	$11,500	$11,500
	pH adjust pumps	1	$3,500	$3,500
	Equalization basin	1	$657,400	$657,400
	Equipment structural support			
	Pump station 1 platform	1	$16,000	$16,000
	Pump station 2 platform	1	$16,000	$16,000
	Pump station 3 platform	1	$16,000	$16,000
	Pump station 4 platform	1	$16,000	$16,000
	Pump station 5 platform	1	$16,000	$16,000
	Buildings			
	Chlorination system	1	$6,000	$6,000
	Dechlorination system	1	$2,000	$2,000
	Electrical and process control			
	Power/equipment	1	$195,800	$195,800
	Control/instrumentation	1	$117,000	$117,000
	UFC compliance costs	1	$250,600	$250,600
	Building Services (includes sodium hypochlorite storage and delivery costs)	1	$12,300	$12,300
	Subtotal			**$3,783,900**

Table 10-5 (continued)

2,700,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$47,400
	Spare parts (1.5%)			$71,100
	Engineering procurement and contract management (12%)			$568,900
	Commissioning (3%)			$142,200
	Owner team (10%)			$474,100
	Subtotal			**$1,303,700**
Total costs	Total direct and indirect costs			$6,044,500
	Contingency (20%)			$1,208,900
	Total Project Cost			**$7,253,400**

Table 10-6

Design Specifications for Metals Precipitation Model Treatment Systems for Blast Furnace and Sintering Wastewater

Item	Type	150,000 gpd		750,000 gpd		2,000,000 gpd	
		Number	Size	Number	Size	Number	Size
Pump station 1	Vertical turbine	2 pumps	1/2 HP	2 pumps	3 HP	2 pumps	7.5 HP
Pump station 2	Vertical turbine	2 pumps	2 HP	2 pumps	10 HP	2 pumps	25 HP
Clarifier pump	Diaphragm/ANSI	2	1/3 HP (diaphragm)	2	1 HP (diaphragm)	2	1/2 HP (ANSI)
Filter press pump	Diaphragm	2	1/3 HP	2	1/3 HP	2	3 BHP
NaOH pump	ANSI	2	1/3 HP	2	1/2 HP	2	1.5 BHP
Acid pump	Diaphragm	2	1/3 HP	2	1/3 HP	2	3 BHP
Sump	Concrete	1	10 ft^3	1	40 ft^3	1	80 ft^3
Equalization basin	Concrete	1	5,100 ft^3	1	26,000 ft^3	1	67,000 ft^3
Reactor clarifier	Mild steel	1	15 ft diameter × 12 ft side/ 1 HP & 2.5 HP	1	35 ft diameter × 12 ft side/ 1 HP & 5 HP	1	51 ft diameter × 12 ft side/2 HP & 10 HP
Clarifier overflow	Concrete	1	450 ft^3	1	1,260 ft^3	1	14,000 ft^3
NaOH tank	Carbon steel	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side
Acid tank	FRP	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side
pH control tank	Stainless	1	90 ft^3/1HP	1	450 ft^3/1HP	1	1,200 ft^3/3 HP
Filter press	Pneumatic	1	18 ft × 7 ft × 6 ft/10 HP & 7.5 HP	1	18 ft × 7 ft × 6 ft/10 HP & 7.5 HP	1	18 ft × 7 ft × 6 ft/ 10 HP & 7.5 HP

FRP - Fiberglass, reinforced plastic.
ANSI - American National Standards Institute.

Table 10-7

Estimated Investment Costs for Metals Precipitation Model Treatment Systems for Blast Furnace and Sintering Wastewater (150,000 - 2,000,000 gpd)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Reactor clarifier	1	$40,000	$40,000
	pH control tank	1	$8,900	$8,900
	Acid/NaOH tanks	4	$10,000	$40,000
	Filter press	1	$175,000	$175,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$3,000	$6,000
	Clarifier pumps	2	$2,200	$4,400
	Filter press pumps	2	$2,200	$4,400
	NaOH pumps	2	$5,500	$11,000
	Acid pumps	2	$2,200	$4,400
	Total freight			**$8,900**
	Subtotal			**$306,000**
Installation	**Mechanical equipment installation**			
	Reactor clarifier	1	$110,000	$110,000
	pH control tank	1	$2,300	$2,300
	Acid/NaOH tanks	4	$1,000	$4,000
	Filter press	1	$52,500	$52,500
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$1,500	$3,000
	Clarifier pumps	2	$2,000	$4,000
	Filter press pumps	2	$2,000	$4,000
	NaOH pumps	2	$1,500	$3,000
	Acid pumps	2	$2,000	$4,000

Table 10-7 (continued)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Piping installation**			
	Piping/supports	1	$83,500	$83,500
	Insulation and heat tracing	1	$144,600	$144,600
	Control valves/instrumentation	1	$13,800	$13,800
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Reactor clarifier/overflow tank	1	$37,800	$37,800
	Clarifier pumps	1	$3,500	$3,500
	pH control tank	1	$1,800	$1,800
	Acid/NaOH tanks and pumps	1	$14,000	$14,000
	Filter press	1	$7,000	$7,000
	Equalization basin	1	$90,300	$90,300
	Sump/filter press pumps	1	$6,700	$6,700
	Equipment structural support			
	Pump station 1 platform	1	$2,000	$2,000
	Pump station 2 platform	1	$4,000	$4,000
	Electrical and process control			
	Power/equipment	1	$82,200	$82,200
	Control/instrumentation	1	$78,800	$78,800
	Subtotal			**$759,800**
Indirect costs	Temporary facilities (1%)			$10,700
	Spare parts (1.5%)			$16,000
	Engineering procurement and contract management (12%)			$127,900
	Commissioning (3%)			$32,000
	Owner team (10%)			$106,600
	Subtotal			**$293,200**
Total costs	Total direct and indirect costs			$1,358,900
	Contingency (20%)			$271,800
	Total Project Cost			**$1,630,700**

Table 10-7 (continued)

750,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Reactor clarifier	1	$75,000	$75,000
	pH control tank	1	$23,500	$23,500
	Acid/NaOH tanks	4	$10,000	$40,000
	Filter press	1	$175,000	$175,000
	Pump station 1	2	$5,500	$11,000
	Pump station 2	2	$8,000	$16,000
	Clarifier pumps	2	$3,500	$7,000
	Filter press pumps	2	$2,200	$4,400
	NaOH pumps	2	$8,000	$16,000
	Acid pumps	2	$2,200	$4,400
	Total freight			**$11,200**
	Subtotal			**$383,500**
Installation	**Mechanical equipment installation**			
	Reactor clarifier	1	$162,000	$162,000
	pH control tank	1	$6,000	$6,000
	Acid/NaOH tanks	4	$1,000	$4,000
	Filter press	1	$52,500	$52,500
	Pump station 1	2	$2,000	$4,000
	Pump station 2	2	$2,000	$4,000
	Clarifier pumps	2	$2,000	$4,000
	Filter press pumps	2	$2,000	$4,000
	NaOH pumps	2	$1,500	$3,000
	Acid pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$137,000	$137,000
	Insulation and heat tracing	1	$145,300	$145,300
	Control valves/instrumentation	1	$20,100	$20,100

Table 10-7 (continued)

750,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Civil/structural (includes costs associated with site preparation and grading)**			
	Equipment foundations			
	Reactor clarifier/overflow tank	1	$59,000	$59,000
	Clarifier pumps	1	$3,500	$3,500
	pH control tank	1	$5,300	$5,300
	Acid/NaOH tanks and pumps	1	$14,000	$14,000
	Filter press	1	$7,000	$7,000
	Equalization basin	1	$257,600	$257,600
	Sump/filter press pumps	1	$7,500	$7,500
	Equipment structural support			
	Pump station 1 platform	1	$4,000	$4,000
	Pump station 2 platform	1	$8,000	$8,000
	Electrical and process control			
	Power/equipment	1	$82,200	$82,200
	Control/instrumentation	1	$78,800	$78,800
	Subtotal			**$1,076,800**
Indirect costs	Temporary facilities (1%)			$14,600
	Spare parts (1.5%)			$21,900
	Engineering procurement and contract management (12%)			$175,200
	Commissioning (3%)			$43,800
	Owner team (10%)			$146,000
	Subtotal			**$401,500**
Total costs	Total direct and indirect costs			$1,861,900
	Contingency (20%)			$372,400
	Total Project Cost			**$2,234,300**

Table 10-7 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Reactor clarifier	1	$130,000	$130,000
	pH control tank	1	$47,400	$47,400
	Acid/NaOH tanks	4	$10,000	$40,000
	Filter press	1	$175,000	$175,000
	Pump station 1	2	$9,000	$18,000
	Pump station 2	2	$9,500	$19,000
	Clarifier pumps	2	$5,500	$11,000
	Filter press pumps	2	$2,200	$4,400
	NaOH pumps	2	$8,500	$17,000
	Acid pumps	2	$7,500	$15,000
	Total freight			**$14,300**
	Subtotal			**$491,100**
Installation	**Mechanical equipment installation**			
	Reactor clarifier	1	$253,000	$253,000
	pH control tank	1	$12,000	$12,000
	Acid/NaOH tanks	4	$10,000	$40,000
	Filter press	1	$52,500	$52,500
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$2,500	$5,000
	Clarifier pumps	2	$1,500	$3,000
	Filter press pumps	2	$2,000	$4,000
	NaOH pumps	2	$2,000	$4,000
	Acid pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$174,200	$174,200
	Insulation and heat tracing	1	$149,800	$149,800
	Control valves/instrumentation	1	$24,600	$24,600

Table 10-7 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Civil/structural (includes costs associated with site preparation and grading)**			
	Equipment foundations			
	Reactor clarifier/overflow tank	1	$224,800	$224,800
	Clarifier pumps	1	$7,000	$7,000
	pH control tank	1	$10,500	$10,500
	Acid/NaOH tanks and pumps	1	$17,500	$17,500
	Filter press	1	$8,700	$8,700
	Equalization basin	1	$508,300	$508,300
	Sump/filter press pumps	1	$12,500	$12,500
	Equipment structural support			
	Pump station 1 platform	1	$6,000	$6,000
	Pump station 2 platform	1	$8,000	$8,000
	Electrical and process control			
	Power/equipment	1	$105,900	$105,900
	Control/instrumentation	1	$78,800	$78,800
	Subtotal			**$1,719,100**
Indirect costs	Temporary facilities (1%)			$22,100
	Spare parts (1.5%)			$33,200
	Engineering procurement and contract management (12%)			$265,200
	Commissioning (3%)			$66,300
	Owner team (10%)			$221,000
	Subtotal			**$607,800**
Total costs	Total direct and indirect costs			$2,818,000
	Contingency (20%)			$563,600
	Total Project Cost			**$3,381,600**

Table 10-8

Design Specifications for Breakpoint Chlorination Model Treatment Systems for Blast Furnace and Sintering Wastewater

Item	Type	150,000 gpd		750,000 gpd		2,000,000 gpd	
		Number	Size	Number	Size	Number	Size
Pump station 1	Vertical turbine	2 pumps	1 HP	2 pumps	4 HP	2 pumps	10 HP
Pump station 2	Vertical turbine	2 pumps	1 HP	2 pumps	3 HP	2 pumps	7.5 HP
Pump station 3	Vertical turbine	2 pumps	1 HP	2 pumps	3 HP	2 pumps	7.5 HP
Pump station 4	Vertical turbine	2 pumps	1 HP	2 pumps	3 HP	2 pumps	7.5 HP
pH adjust pump	Diaphragm	2	3 HP	2	3 HP	2	3 HP
NaOH pump	Diaphragm	2	1/2 HP	2	1/2 HP	2	1/2 HP
Equalization basin	Concrete	1	5,100 ft^3	1	25,000 ft^3	1	67,000 ft^3
Chlorination mixing tank	Concrete	1	11 ft × 10 ft × 5 ft/5 HP	1	20 ft × 15 ft × 10 ft/20 HP	1	25 ft × 20 ft × 15 ft/3 @ 20 HP
Chlorination system	Building	1	10 ft × 9 ft × 20 ft/3 HP	1	10 ft × 9 ft × 20 ft/3 HP	1	15 ft × 20 ft × 20 ft/2 @ 3 HP
Retention tank	Concrete	1	50 ft × 11 ft × 10 ft	1	50 ft × 30 ft × 20 ft	1	80 ft × 50 ft × 20 ft
Dechlorination tank	Concrete	1	11 ft × 10 ft × 5 ft/5 HP	1	20 ft × 15 ft × 10 ft/20 HP	1	25 ft × 20 ft × 15 ft/3 @ 20 HP
Dechlorination system	Building/tank pad	1	8 ft × 8 ft × 15 ft/10 ft × 10 ft	1	8 ft × 8 ft × 15 ft/10 ft × 10 ft	1	8 ft × 8 ft × 15 ft/10 ft × 10 ft
Dechlorination system sodium bisulfite storage tank	Fiberglass/tank foundation	1	400 gal	1	1,000 gal	1	7,000 gal
NaOH tank	Carbon steel	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side

FRP - Fiberglass, reinforced plastic.
ANSI - American National Standards Institute.

Table 10-9

Estimated Investment Costs for Breakpoint Chlorination Model Treatment Systems for Blast Furnace and Sintering Wastewater (150,000 - 2,000,000 gpd)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Chlorination/dechlorination mixing systems	1	$41,700	$41,700
	NaOH tanks	2	$10,000	$20,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$1,500	$3,000
	Pump station 3	2	$1,500	$3,000
	Pump station 4	2	$1,500	$3,000
	pH adjust pumps	2	$2,200	$4,400
	Sodium bisulfite storage tank	1	$4,500	$4,500
	NaOH pumps	2	$2,200	$4,400
	Total freight			**$2,600**
	Subtotal			**$89,600**
Installation	**Mechanical equipment installation**			
	Chlorination/dechlorination mixing systems	1	$12,500	$12,500
	NaOH tanks	2	$1,000	$2,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$1,500	$3,000
	Pump station 3	2	$1,500	$3,000
	Pump station 4	2	$1,500	$3,000
	pH adjust pumps	2	$2,000	$4,000
	NaOH pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$74,700	$74,700
	Insulation and heat tracing	1	$119,000	$119,000
	Control valves/instrumentation	1	$18,800	$18,800

Table 10-9 (continued)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Civil/structural (includes costs associated with site preparation and grading)**			
	Equipment foundations			
	NaOH pumps	1	$3,500	$3,500
	NaOH tanks	1	$4,200	$4,200
	Chlorination mixing tank	1	$25,100	$25,100
	Chlorination system	1	$12,600	$12,600
	Retention tank	1	$118,500	$118,500
	Dechlorination mixing tank	1	$25,100	$25,100
	Dechlorination system	1	$12,500	$12,500
	pH adjust pumps	1	$3,500	$3,500
	Equalization basin	1	$77,800	$77,800
	Equipment structural support			
	Pump station 1 platform	1	$4,000	$4,000
	Pump station 2 platform	1	$4,000	$4,000
	Pump station 3 platform	1	$4,000	$4,000
	Pump station 4 platform	1	$4,000	$4,000
	Buildings			
	Chlorination system	1	$2,000	$2,000
	Dechlorination system	1	$2,000	$2,000
	Electrical and process control			
	Power/equipment	1	$71,900	$71,900
	Control/instrumentation	1	$67,300	$67,300
	UFC compliance costs	1	$250,600	$250,600
	Building Services (includes sodium hypochlorite storage and delivery costs)	1	$4,800	$4,800
	Subtotal			**$944,400**

Table 10-9 (continued)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$10,300
	Spare parts (1.5%)			$15,500
	Engineering procurement and contract management (12%)			$124,100
	Commissioning (3%)			$31,000
	Owner team (10%)			$103,400
	Subtotal			**$284,400**
Total costs	Total direct and indirect costs			$1,318,400
	Contingency (20%)			$263,700
	Total Project Cost			**$1,582,000**

750,000 gallon per day				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Chlorination/dechlorination mixing systems	1	$193,500	$193,500
	NaOH tanks	2	$10,000	$20,000
	Pump station 1	2	$5,000	$10,000
	Pump station 2	2	$5,000	$10,000
	Pump station 3	2	$5,000	$10,000
	Pump station 4	2	$5,000	$10,000
	pH adjust pumps	2	$2,200	$4,400
	Sodium bisulfite storage tank	1	$5,300	$5,300
	NaOH pumps	2	$2,200	$4,400
	Total freight			**$8,800**
	Subtotal			**$276,400**
Installation	**Mechanical equipment installation**			
	Chlorination/dechlorination mixing systems	1	$58,100	$58,100
	NaOH tanks	2	$1,000	$2,000
	Pump station 1	2	$2,000	$4,000
	Pump station 2	2	$2,000	$4,000
	Pump station 3	2	$2,000	$4,000
	Pump station 4	2	$2,000	$4,000
	pH adjust pumps	2	$2,000	$4,000
	NaOH pumps	2	$2,000	$4,000

Table 10-9 (continued)

750,000 gallon per day				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Piping installation**			
	Piping/supports	1	$127,000	$127,000
	Insulation and heat tracing	1	$122,800	$122,800
	Control valves/instrumentation	1	$24,900	$24,900
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	NaOH pumps	1	$3,500	$3,500
	NaOH tanks	1	$4,200	$4,200
	Chlorination mixing tank	1	$64,800	$64,800
	Chlorination system	1	$12,600	$12,600
	Retention tank	1	$385,100	$385,100
	Dechlorination mixing tank	1	$64,800	$64,800
	Dechlorination system	1	$12,600	$12,600
	pH adjust pumps	1	$3,500	$3,500
	Equalization basin	1	$264,400	$264,400
	Equipment structural support			
	Pump station 1 platform	1	$8,000	$8,000
	Pump station 2 platform	1	$8,000	$8,000
	Pump station 3 platform	1	$8,000	$8,000
	Pump station 4 platform	1	$8,000	$8,000
	Buildings			
	Chlorination system	1	$2,000	$2,000
	Dechlorination system	1	$2,000	$2,000
	Electrical and process control			
	Power/equipment	1	$74,000	$74,000
	Control/instrumentation	1	$67,300	$67,300
	UFC compliance costs	1	$250,600	$250,600
	Building Services (includes sodium hypochlorite storage and delivery costs)	1	$6,600	$6,600
	Subtotal			**$1,608,700**

Table 10-9 (continued)

750,000 gallon per day				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$19,500
	Spare parts (1.5%)			$29,300
	Engineering procurement and contract management (12%)			$234,500
	Commissioning (3%)			$58,600
	Owner team (10%)			$195,400
	Subtotal			**$537,300**
Total costs	Total direct and indirect costs			$2,422,400
	Contingency (20%)			$484,500
	Total Project Cost			**$2,906,900**

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Chlorination/dechlorination mixing systems	1	$506,100	$506,100
	NaOH tanks	2	$10,000	$20,000
	Pump station 1	2	$9,000	$18,000
	Pump station 2	2	$9,000	$18,000
	Pump station 3	2	$9,000	$18,000
	Pump station 4	2	$9,000	$18,000
	pH adjust pumps	2	$2,200	$4,400
	Sodium bisulfite storage tank	1	$13,300	$13,300
	NaOH pumps	2	$2,200	$4,400
	Total freight			**$20,700**
	Subtotal			**$640,900**
Installation	**Mechanical equipment installation**			
	Chlorination/dechlorination mixing systems	1	$151,800	$151,800
	NaOH tanks	2	$1,000	$2,000
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$2,500	$5,000
	Pump station 3	2	$2,500	$5,000
	Pump station 4	2	$2,500	$5,000
	pH adjust pumps	2	$2,000	$4,000

Table 10-9 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Piping installation**			
	Piping/supports	1	$156,900	$156,900
	Insulation and heat tracing	1	$126,700	$126,700
	Control valves/instrumentation	1	$28,900	$28,900
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	NaOH pumps	1	$3,500	$3,500
	NaOH tanks	1	$4,200	$4,200
	Chlorination mixing tank	1	$120,300	$120,300
	Chlorination system	1	$31,100	$31,100
	Retention tank	1	$746,600	$746,600
	Dechlorination mixing tank	1	$120,300	$120,300
	Dechlorination system	1	$12,500	$12,500
	pH adjust pumps	1	$3,500	$3,500
	Equalization basin	1	$544,900	$544,900
	Equipment structural support			
	Pump station 1 platform	1	$16,000	$16,000
	Pump station 2 platform	1	$16,000	$16,000
	Pump station 3 platform	1	$16,000	$16,000
	Pump station 4 platform	1	$16,000	$16,000
	Buildings			
	Chlorination system	1	$6,000	$6,000
	Dechlorination system	1	$2,000	$2,000
	Electrical and process control			
	Power/equipment	1	$114,000	$114,000
	Control/instrumentation	1	$86,500	$86,500
	UFC compliance costs	1	$250,600	$250,600
	Building Services (includes sodium hypochlorite storage and delivery costs)	1	$10,500	$10,500
	Subtotal			**$2,614,800**

Table 10-9 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$34,500
	Spare parts (1.5%)			$51,800
	Engineering procurement and contract management (12%)			$413,900
	Commissioning (3%)			$103,500
	Owner team (10%)			$344,900
	Subtotal			**$948,400**
Total costs	Total direct and indirect costs			$4,204,100
	Contingency (20%)			$840,800
	Total Project Cost			**$5,044,900**

Table 10-10

Design Specifications for Metals Precipitation Model Treatment Systems for Basic Oxygen Furnace, Vacuum Degassing, and Continuous Casting Wastewater

		150,000 gpd		750,000 gpd		2,000,000 gpd	
Item	**Type**	**Number**	**Size**	**Number**	**Size**	**Number**	**Size**
Pump station 1	Vertical turbine	2 pumps	1/2 HP	2 pumps	3 HP	2 pumps	7.5 HP
Pump station 2	Vertical turbine	2 pumps	2 HP	2 pumps	10 HP	2 pumps	25 HP
Clarifier pumps	Diaphragm/ANSI	2 pumps	1/3 HP (diaphragm)	2 pumps	1 HP (diaphragm)	2 pumps	1/2 HP (ANSI)
NaOH pump	ANSI	2 pumps	1/3 HP	2 pumps	1/2 HP	2 pumps	1.5 BHP
Acid pump	Diaphragm	2 pumps	1/3 HP	2 pumps	1/3 HP	2 pumps	3 BHP
Equalization basin	Steel/Mixer	1	5,100 ft^3/1.5HP	1	26,000 ft^3/5 HP	1	67,000 ft^3/10 HP
pH adjustment tank	Steel/Mixer	1	300 ft^3/1.75HP	1	1,500 ft^3/3.5HP	1	3,500 ft^3/7.5HP
Flash mix tank	Steel/Mixer	1	50 ft^3/0.3HP	1	200 ft^3/1.17HP	1	500 ft^3/3.5HP
Flocculation tank	Steel/Mixer	1	300 ft^3/1 HP	1	1,500 ft^3/5 HP	1	3,500 ft^3/10 HP
Clarifier	Mild Steel	1	15 ft diameter × 12 ft side/ 1 HP & 2.5 HP	1	35 ft diameter × 12 ft side/ 1 HP & 5 HP	1	51 ft diameter × 12 ft side/2 HP & 10 HP
Clarifier overflow	Concrete	1	450 ft^3/2 HP	1	1,260 ft^3/10 HP	1	14,000 ft^3/20 HP
NaOH tank	Carbon steel	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side
Acid tank	FRP	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side	2	10 ft diameter × 10 ft side
pH control tank	Stainless	1	90 ft^3/1HP	1	450 ft^3/1HP	1	1200 ft^3/3 HP

FRP - Fiberglass, reinforced plastic.
ANSI - American National Standards Institute.

Table 10-11

Estimated Investment Costs for Metals Precipitation Model Treatment Systems for Basic Oxygen Furnace, Vacuum Degassing, and Continuous Casting Wastewater (150,000 - 2,000,000 gpd)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Mixer (for equalization basin)	1	$23,000	$23,000
	Flash mix tank (with mixer)	1	$5,000	$5,000
	Flocculation tank (with slow speed mixer)	1	$18,300	$18,300
	Clarifier	1	$94,500	$94,500
	pH control tank	1	$8,900	$8,900
	Acid/NaOH tanks	4	$10,000	$40,000
	pH adjust tank	1	$11,300	$11,300
	Mixer (for pH adjust tank)	1	$8,500	$8,500
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$3,000	$6,000
	Clarifier pumps	2	$2,200	$4,400
	NaOH pumps	2	$5,500	$11,000
	Acid pumps	2	$2,200	$4,400
	Total freight			**$7,100**
	Subtotal			**$245,400**
Installation	**Mechanical equipment installation**			
	Mixer (for equalization basin)	1	$1,400	$1,400
	Flash mix tank (with mixer)	1	$1,000	$1,000
	Flocculation tank (with slow speed mixer)	1	$1,000	$1,000
	Clarifier	1	$40,500	$40,500
	pH control tank	1	$2,300	$2,300
	Acid/NaOH tanks	4	$1,000	$4,000
	pH adjust tanks	1	$1,000	$1,000
	Mixer (for pH adjust tank)	1	$500	$500
	Pump station 1	2	$1,500	$3,000

Table 10-11 (continued)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	Pump station 2	2	$1,500	$3,000
	Clarifier pumps	2	$2,000	$4,000
	NaOH pumps	2	$1,500	$3,000
	Acid pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$82,800	$82,800
	Insulation and heat tracing	1	$142,700	$142,700
	Control valves/instrumentation	1	$13,700	$13,700
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Clarifier/overflow tank	1	$37,800	$37,800
	Clarifier pumps	1	$3,500	$3,500
	Flash mix tank (with mixer)	1	$800	$800
	Flocculation tank (with slow speed mixer)	1	$2,000	$2,000
	pH control tank	1	$1,800	$1,800
	Acid/NaOH tanks and pumps	1	$14,000	$14,000
	pH adjust tank	1	$2,000	$2,000
	Equalization basin	1	$90,300	$90,300
	Equipment structural support			
	Pump station 1 platform	1	$2,000	$2,000
	Pump station 2 platform	1	$4,000	$4,000
	Electrical and process control			
	Power/equipment	1	$68,400	$68,400
	Control/instrumentation	1	$63,500	$63,500
	Software	1	$28,000	$28,000
	Subtotal			**$626,000**

Table 10-11 (continued)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$8,700
	Spare parts (1.5%)			$13,100
	Engineering procurement and contract management (12%)			$104,600
	Commissioning (3%)			$26,100
	Owner team (10%)			$87,100
	Subtotal			**$239,600**
Total costs	Total direct and indirect costs			$1,111,000
	Contingency (20%)			$222,200
	Total Project Cost			**$1,333,200**

750,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Mixer (for equalization basin)	1	$50,000	$50,000
	Flash mix tank (with mixer)	1	$18,000	$18,000
	Flocculation tank (with slow speed mixer)	1	$49,000	$49,000
	Clarifier	1	$155,000	$155,000
	pH control tank	1	$23,500	$23,500
	Acid/NaOH tanks	4	$10,000	$40,000
	pH adjust tank	1	$34,500	$34,500
	Mixer (for pH adjust tank)	1	$10,000	$10,000
	Pump station 1	2	$5,500	$11,000
	Pump station 2	2	$8,000	$16,000
	Clarifier pumps	2	$3,500	$7,000
	NaOH pumps	2	$8,000	$16,000
	Acid pumps	2	$2,200	$4,400
	Total freight			**$13,000**
	Subtotal			**$447,400**
Installation	**Mechanical equipment installation**			
	Mixer (for equalization basin)	1	$1,400	$1,400
	Flash mix tank (with mixer)	1	$1,000	$1,000

Table 10-11 (continued)

750,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	Flocculation tank (with slow speed mixer)	1	$1,500	$1,500
	Clarifier	1	$70,000	$70,000
	pH control tank	1	$6,000	$6,000
	Acid/NaOH tanks	4	$1,000	$4,000
	pH adjust tank	1	$1,000	$1,000
	Mixer (for pH adjust tank)	1	$500	$500
	Pump station 1	2	$2,000	$4,000
	Pump station 2	2	$2,000	$4,000
	Clarifier pumps	2	$2,000	$4,000
	NaOH pumps	2	$1,500	$3,000
	Acid pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$136,300	$136,300
	Insulation and heat tracing	1	$145,400	$145,400
	Control valves/instrumentation	1	$20,000	$20,000
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Clarifier/overflow tank	1	$59,000	$59,000
	Clarifier pumps	1	$3,500	$3,500
	Flash mix tank (with mixer)	1	$1,300	$1,300
	Flocculation tank (with slow speed mixer)	1	$6,200	$6,200
	pH control tank	1	$5,300	$5,300
	Acid/NaOH tanks and pumps	1	$14,000	$14,000
	pH adjust tank	1	$6,200	$6,200
	Equalization basin	1	$257,700	$257,700
	Equipment structural support			
	Pump station 1 platform	1	$4,000	$4,000
	Pump station 2 platform	1	$8,000	$8,000
	Electrical and process control			
	Power/equipment	1	$68,400	$68,400

Table 10-11 (continued)

750,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	Control/instrumentation	1	$63,500	$63,500
	Software	1	$28,000	$28,000
	Subtotal			**$931,200**
Indirect costs	Temporary facilities (1%)			$13,800
	Spare parts (1.5%)			$20,700
	Engineering procurement and contract management (12%)			$165,400
	Commissioning (3%)			$41,400
	Owner team (10%)			$137,900
	Subtotal			**$379,200**
Total costs	Total direct and indirect costs			$1,757,700
	Contingency (20%)			$351,500
	Total Project Cost			**$2,109,300**

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Mixer (for equalization basin)	1	$110,000	$110,000
	Flash mix tank (with mixer)	1	$25,500	$25,500
	Flocculation tank (with slow speed mixer)	1	$96,400	$96,400
	Clarifier	1	$238,000	$238,000
	pH control tank	1	$47,400	$47,400
	Acid/NaOH tanks	4	$10,000	$40,000
	pH adjust tank	1	$74,900	$74,900
	Mixer (for pH adjust tank)	1	$16,000	$16,000
	Pump station 1	2	$9,000	$18,000
	Pump station 2	2	$9,500	$19,000
	Clarifier pumps	2	$5,500	$11,000
	NaOH pumps	2	$8,500	$17,000
	Acid pumps	2	$7,500	$15,000
	Total freight			**$21,800**
	Subtotal			**$750,000**

Table 10-11 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation	**Mechanical equipment installation**			
	Mixer (for equalization basin)	1	$2,000	$2,000
	Flash mix tank (with mixer)	1	$1,000	$1,000
	Flocculation tank (with slow speed mixer)	1	$1,500	$1,500
	Clarifier	1	$102,000	$102,000
	pH control tank	1	$12,000	$12,000
	Acid/NaOH tanks	4	$10,000	$40,000
	pH adjust tank	1	$1,200	$1,200
	Mixer (for pH adjust tank)	1	$500	$500
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$2,500	$5,000
	Clarifier pumps	2	$1,500	$3,000
	NaOH pumps	2	$2,000	$4,000
	Acid pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$127,100	$127,100
	Insulation and heat tracing	1	$153,000	$153,000
	Control valves/instrumentation	1	$63,500	$63,500
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Reactor clarifier/overflow tank	1	$224,800	$224,800
	Clarifier pumps	1	$7,000	$7,000
	Flash mix tank (with mixer)	1	$2,800	$2,800
	Flocculation tank (with slow speed mixer)	1	$13,000	$13,000
	pH control tank	1	$10,500	$10,500
	Acid/NaOH tanks and pumps	1	$17,500	$17,500
	pH adjust tank	1	$13,000	$13,000
	Equalization basin	1	$508,300	$508,300
	Equipment structural support			
	Pump station 1 platform	1	$6,000	$6,000

Table 10-11 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	Pump station 2 platform	1	$8,000	$8,000
	Electrical and process control			
	Power/equipment	1	$92,100	$92,100
	Control/instrumentation	1	$63,500	$63,500
	Software	1	$28,000	$28,000
	Subtotal			**$1,519,300**
Indirect costs	Temporary facilities (1%)			$22,700
	Spare parts (1.5%)			$34,000
	Engineering procurement and contract management (12%)			$272,300
	Commissioning (3%)			$68,100
	Owner team (10%)			$226,900
	Subtotal			**$624,100**
Total costs	Total direct and indirect costs			$2,893,400
	Contingency (20%)			$578,700
	Total Project Cost			**$3,472,000**

Table 10-12

Design Specifications for Multimedia Filtration Model Treatment Systems

		150,000 gpd		500,000 gpd		2,000,000 gpd		7,500,000 gpd		20,000,000 gpd	
Item	**Type**	**Number**	**Size**	**Number**	**Size**	**Number**	**Size**	**Number**	**Size**	**Number**	**Size**
Pump station 1	Horizontal split	2 pumps	1.5 HP	2 pumps	5 HP	2 pumps	20 HP	2 pumps	25 HP	2 pumps	60 HP
Pump station 2	Diaphragm/ Vertical turbine (a)	2 pumps	3 HP	2 pumps	3 HP	2 pumps	1 HP	2 pumps	3 HP	2 pumps	3 HP
Filter backwash pump	Vertical turbine	2	1.5 HP	2	3 HP	2	10 HP	2	10 HP	2	20 HP
Sump 1	Concrete	1	450 ft^3	1	800 ft^3	1	3,000 ft^3	1	3,000 ft^3	1	6,000 ft^3
Filter backwash surge basin	Concrete	1	450 ft^3	1	800 ft^3	1	3,000 ft^3	1	3,000 ft^3	1	6,000 ft^3
Filtration system	Sand pressure	2	6 ft diameter × 9 ft side/ 7.5 HP	2	8 ft diameter × 9 ft side/ 7.5 HP	2	12 ft diameter × 9 ft side/ 20 HP	8	12 ft diameter × 9 ft side/ 20 HP	8	16' diam. × 9' side/ 60 HP

(a) Diaphragm pumps (150,000 gpd - 500,000 gpd); vertical turbine pumps (2,000,000 - 20,000,000 gpd).

Table 10-13

Estimated Investment Costs for Multimedia Filtration Model Treatment Systems (150,000 - 20,000,000 gallons per day)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Filters	2	$100,000	$200,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$2,200	$4,400
	Filter backwash pumps	2	$3,000	$6,000
	Total freight			**$6,400**
	Subtotal			**$219,800**
Installation	**Mechanical equipment installation**			
	Filters	2	$11,000	$22,000
	Pump station 1	2	$1,500	$3,000
	Pump station 2	2	$2,000	$4,000
	Filter backwash pumps	2	$1,500	$3,000
	Piping installation			
	Piping/supports	1	$87,800	$87,800
	Insulation and heat tracing	1	$116,100	$116,100
	Control valves/instrumentation	1	$14,600	$14,600
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Filtration plant	1	$81,900	$81,900
	Sump 1	1	$19,000	$19,000
	Filter backwash surge basin	1	$19,000	$19,000
	Equipment structural support			
	Pump station 1 platform	1	$3,500	$3,500
	Pump station 2 platform	1	$4,000	$4,000
	Filter backwash pumps	1	$4,000	$4,000
	Buildings			
	Filtration plant	1	$24,500	$24,500

Table 10-13 (continued)

150,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Electrical and process control**			
	Power/equipment	1	$43,600	$43,600
	Control/instrumentation	1	$40,600	$40,600
	Building services	1	$5,100	$5,100
	Software	1	$30,000	$30,000
	Subtotal			**$525,700**
Indirect costs	Temporary facilities (1%)			$7,500
	Spare parts (1.5%)			$11,200
	Engineering procurement and contract management (12%)			$89,500
	Commissioning (3%)			$22,400
	Owner team (10%)			$74,600
	Subtotal			**$205,200**
Total costs	Total direct and indirect costs			$950,500
	Contingency (20%)			$190,100
	Total Project Cost			**$1,140,600**

500,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Filters	2	$105,000	$210,000
	Pump station 1	2	$5,000	$10,000
	Pump station 2	2	$3,500	$7,000
	Filter backwash pumps	2	$5,000	$10,000
	Total freight			**$7,100**
	Subtotal			**$244,100**
Installation	**Mechanical equipment installation**			
	Filters	2	$13,000	$26,000
	Pump station 1	2	$2,000	$4,000
	Pump station 2	2	$2,000	$4,000
	Filter backwash pumps	2	$1,500	$3,000

Table 10-13 (continued)

500,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	**Piping installation**			
	Piping/supports	1	$121,600	$121,600
	Insulation and heat tracing	1	$118,000	$118,000
	Control valves/instrumentation	1	$17,400	$17,400
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Filtration plant	1	$97,800	$97,800
	Sump 1	1	$22,000	$22,000
	Filter backwash surge basin	1	$22,000	$22,000
	Equipment structural support			
	Pump station 1 platform	1	$7,000	$7,000
	Pump station 2 platform	1	$4,000	$4,000
	Filter backwash pumps	1	$4,000	$4,000
	Buildings			
	Filtration plant	1	$28,000	$28,000
	Electrical and process control			
	Power/equipment	1	$43,600	$43,600
	Control/instrumentation	1	$40,600	$40,600
	Building services	1	$5,800	$5,800
	Software	1	$30,000	$30,000
	Subtotal			**$598,800**
Indirect costs	Temporary facilities (1%)			$8,000
	Spare parts (1.5%)			$12,600
	Engineering procurement and contract management (12%)			$101,200
	Commissioning (3%)			$25,300
	Owner team (10%)			$84,300
	Subtotal			**$231,800**
Total costs	Total direct and indirect costs			$1,074,700
	Contingency (20%)			$214,900
	Total Project Cost			**$1,289,600**

Table 10-13 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Filters	2	$107,500	$215,000
	Pump station 1	2	$9,000	$18,000
	Pump station 2	2	$1,500	$3,000
	Filter backwash pumps	2	$9,000	$18,000
	Total freight			**$7,600**
	Subtotal			**$261,600**
Installation	**Mechanical equipment installation**			
	Filters	2	$12,000	$24,000
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$1,500	$3,000
	Filter backwash pumps	2	$2,000	$4,000
	Piping installation			
	Piping/supports	1	$197,400	$197,400
	Insulation and heat tracing	1	$122,700	$122,700
	Control valves/instrumentation	1	$28,500	$28,500
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Filtration plant	1	$212,300	$212,300
	Sump 1	1	$53,200	$53,200
	Filter backwash surge basin	1	$53,200	$53,200
	Equipment structural support			
	Pump station 1 platform	1	$10,500	$10,500
	Pump station 2 platform	1	$4,000	$4,000
	Filter backwash pumps	1	$8,000	$8,000
	Buildings			
	Filtration plant	1	$60,000	$60,000
	Electrical and process control			
	Power/equipment	1	$68,800	$68,800
	Control/instrumentation	1	$44,400	$44,400
	Building services	1	$12,500	$12,500
	Software	1	$32,000	$32,000
	Subtotal			**$943,500**

Table 10-13 (continued)

2,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$12,100
	Spare parts (1.5%)			$18,100
	Engineering procurement and contract management (12%)			$144,600
	Commissioning (3%)			$36,200
	Owner team (10%)			$120,500
	Subtotal			**$331,400**
Total costs	Total direct and indirect costs			$1,536,500
	Contingency (20%)			$307,300
	Total Project Cost			**$1,843,800**

7,500,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Filters	8	$107,500	$860,000
	Pump station 1	2	$9,000	$18,000
	Pump station 2	2	$5,000	$10,000
	Filter backwash pumps	2	$9,000	$18,000
	Total freight			**$27,200**
	Subtotal			**$933,200**
Installation	**Mechanical equipment installation**			
	Filters	8	$12,000	$96,000
	Pump station 1	2	$2,500	$5,000
	Pump station 2	2	$2,000	$4,000
	Filter backwash pumps	2	$2,500	$5,000
	Piping installation			
	Piping/supports	1	$319,500	$319,500
	Insulation and heat tracing	1	$137,700	$137,700
	Control valves/instrumentation	1	$45,600	$45,600
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			

Table 10-13 (continued)

7,500,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Installation (cont.)	Filtration plant	1	$337,200	$337,200
	Sump 1	1	$53,200	$53,200
	Filter backwash surge basin	1	$53,200	$53,200
	Equipment structural support			
	Pump station 1 platform	1	$10,500	$10,500
	Pump station 2 platform	1	$4,000	$4,000
	Filter backwash pumps	1	$8,000	$8,000
	Buildings			
	Filtration plant	1	$95,000	$95,000
	Electrical and process control			
	Power/equipment	1	$130,300	$130,300
	Control/instrumentation	1	$63,500	$63,500
	Building services	1	$19,800	$19,800
	Software	1	$42,000	$42,000
	Subtotal			**$1,429,500**
Indirect costs	Temporary facilities (1%)			$23,600
	Spare parts (1.5%)			$35,400
	Engineering procurement and contract management (12%)			$283,500
	Commissioning (3%)			$70,900
	Owner team (10%)			$236,300
	Subtotal			**$649,700**
Total costs	Total direct and indirect costs			$3,012,400
	Contingency (20%)			$602,500
	Total Project Cost			**$3,614,900**

Table 10-13 (continued)

20,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Major equipment	Filters	8	$107,500	$860,000
	Pump station 1	2	$25,000	$50,000
	Pump station 2	2	$5,000	$10,000
	Filter backwash pumps	2	$10,000	$20,000
	Total freight			**$28,200**
	Subtotal			**$968,200**
Installation	**Mechanical equipment installation**			
	Filters	8	$12,000	$96,000
	Pump station 1	2	$4,000	$8,000
	Pump station 2	2	$2,000	$4,000
	Filter backwash pumps	2	$4,000	$8,000
	Piping installation			
	Piping/supports	1	$525,300	$525,300
	Insulation and heat tracing	1	$152,500	$152,500
	Control valves/instrumentation	1	$73,600	$73,600
	Civil/structural (includes costs associated with site preparation and grading)			
	Equipment foundations			
	Filtration plant	1	$466,700	$466,700
	Sump 1	1	$83,600	$83,600
	Filter backwash surge basin	1	$83,600	$83,600
	Equipment structural support			
	Pump station 1 platform	1	$14,000	$14,000
	Pump station 2 platform	1	$14,000	$14,000
	Filter backwash pumps	1	$10,000	$10,000
	Buildings			
	Filtration plant	1	$132,000	$132,000
	Electrical and process control			
	Power/equipment	1	$177,100	$177,100
	Control/instrumentation	1	$63,500	$63,500
	Building services	1	$27,500	$27,500
	Software	1	$42,000	$42,000
	Subtotal			**$1,981,300**

Table 10-13 (continued)

20,000,000 gpd				
Category	**Item**	**Quantity**	**Rate**	**Cost**
Indirect costs	Temporary facilities (1%)			$29,500
	Spare parts (1.5%)			$44,200
	Engineering procurement and contract management (12%)			$353,900
	Commissioning (3%)			$88,500
	Owner team (10%)			$295,000
	Subtotal			**$811,100**
Total costs	Total direct and indirect costs			$3,760,600
	Contingency (20%)			$752,100
	Total Project Cost			**$4,512,700**

Table 10-14

Cost Factors to Determine Investment Costs

Category	Item	Cost Factor (% of equipment cost)
Direct costs (a)	Equipment cost	100
	Freight	3
	Installation labor	40
	Site preparation	15
	Equipment foundations and structural support	40
	Buildings	15
	Piping	35
	Electrical and process control	30
	Subtotal	278
Indirect costs	Temporary facilities (1%) (b)	3
	Spare parts (1.5%) (b)	4
	Engineering procurement and contract management (12%) (b)	34
	Commissioning and start-up (3%) (b)	8
	Owner team (10%) (b)	28
	Subtotal (27.5% of subtotal of direct costs)	77
Total project cost		**355**

(a) Direct cost factors are based on actual wastewater treatment installations in the iron and steel industry and include contingency costs.
(b) Percentage of subtotal of direct costs; standard factors used by engineering and design firm.

Table 10-15

Iron and Steel Investment Cost Equations

Equipment	Investment Cost Equation	Applicable Subcategory	Range of Validity	Source(s)
Biological nitrification (chemicals include soda ash, phosphoric acid, polymer, and defoaming agent)	($): 22,013 × flow (gpm)	Cokemaking	50 to 500 gpm	Capital cost survey
Biological treatment upgrade	($): 1,575.5 × flow (gpm)	Cokemaking	30 to 500 gpm	Capital cost survey, trade association
Tar removal	($): 2,491 × flow (gpm)	Cokemaking	50 to 200 gpm	Vendor, site information
Flow equalization tank (prior to ammonia stripping and biological nitrification)	($): 1440 × flow (gpm) = V (gal) If V is ≤ 250,000 gal, then investment ($) = 1.09 × 250,000 ≤ 500,000 gal, then investment ($) = 1.09 × 500,000 ≤ 750,000 gal, then investment ($) = 1.09 × 750,000 ≤ 1,000,000 gal, then investment ($) = 1.09 × 1,000,000 ≤ 1,250,000 gal, then investment ($) = 1.09 × 1,250,000	Cokemaking	250,000 to 1,250,000 gallons	Capital cost survey, vendor information
Free and fixed ammonia still	($): 11,749 × flow (gpm) + 513,178	Cokemaking	40 to 400 gpm	Capital cost survey, site information, trade association information
Clarification of activated sludge	($): 782.4 × flow rate (gpm)	Cokemaking	20 to 90 ft diameter	Capital cost survey, vendor information

Table 10-15 (continued)

Equipment	Investment Cost Equation	Applicable Subcategory	Range of Validity	Source(s)
Heat exchanger	($): 933 × flow rate (gpm)	Cokemaking	20 to 300 gpm of hot water flow; influent temp: 140°F ; effluent temp: 80°F	Capital cost survey, vendor information
Sludge thickening of activated sludge and metal hydroxides	($): 168.3 × flow (gpm) + 213,320 where flow is through thickener	Cokemaking Steel finishing	0.5 to 1,390 gpm	Capital cost survey, vendor information
Belt filter press	($): 814 × flow (gpm) where flow is through biological nitrification	Cokemaking	4 to 14 tons/day of wet sludge	Capital cost survey, vendor information
Cyanide precipitation (chemicals include ferric sulfate, sulfuric acid, polymer, and sodium hydroxide)	($): 762.36 × flow (gpm) + 113,338 Sulfuric acid feed system: 88.816 × flow (gpm) + 35,692 Ferric sulfate feed system: 79.059 × flow (gpm) + 23,332 Polymer feed system: 68.132 × flow (gpm) + 12,061 Sodium hydroxide feed system: 14.306 × flow (gpm) + 35,927	Cokemaking	40 to 400 gpm	Capital cost survey, vendor information
Breakpoint chlorination of cokemaking wastewater (including sodium hypochlorite, sodium hydroxide, polymer, and sodium bisulfite feed systems)	($): 2,927.5 × flow (gpm) + 2,000,000	Cokemaking	88 to 2,340 gpm	Engineering and design firm
Sludge thickening for iron-cyanide sludge	($): 63,261 × flow (gpm) + 144,799	Cokemaking	40 to 400 gpm	Capital cost survey, vendor information
Plate and frame filter press	($): 117.6 × flow (gpm) + 47,553 (cokemaking) ($): 1,340.8 × flow (gpm) + 47,553 (steel finishing)	Cokemaking Steel finishing	104 to 1,390 gpm	Capital cost survey, vendor information

Table 10-15 (continued)

Equipment	Investment Cost Equation	Applicable Subcategory	Range of Validity	Source(s)
Multimedia filtration	(\$): 488.19 × flow (gpm) + 1,134,220 (50 to 5,200 gpm) 103.43 × flow (gpm) + 3,000,000 (> 5,200 gpm)	Cokemaking Sintering Ironmaking Integrated steelmaking Integrated and stand-alone hot forming Non-Integrated steelmaking and hot forming Other operations	50 to >5,200 gpm	Engineering and design firm
Granular activated carbon	(\$): 950.31 × flow (gpm) + 848,478	Cokemaking	88 to 2,340 gpm	Engineering and design firm
Chemical precipitation	(\$): 1,384.7 × flow (gpm) + 1,503,370 (ironmaking) (\$): 1,545.5 × flow (gpm) + 951,003 (integrated steelmaking) (\$): 748.02 × flow (gpm) + 162,686 (steel finishing)	Ironmaking Integrated steelmaking Steel finishing	104 to 1,390 gpm	Engineering and design firm (ironmaking, integrated steelmaking), vendor information (steel finishing)
Breakpoint chlorination of blast furnace and sintering wastewater	(\$): 2,729.4 × flow (gpm) + 1,000,000	Ironmaking	104 to 1,390 gpm	Engineering and design firm
Vacuum filtration	(\$): 1.13 × (sludge generation (lbs/day)) + 151,037 where sludge generation is 26 lbs/day/gpm	Ironmaking	104 to 1,390 gpm	Capital cost survey, vendor information
Carbon dioxide injection system	(\$): 101,511 < 2,400 gpm (\$): 106,125 2,400 to 5,600 gpm (\$): 115,353 > 5,600 gpm	Integrated steelmaking	< 2,400 to > 5,600 gpm	Vendor, site information

Table 10-15 (continued)

Equipment	Investment Cost Equation	Applicable Subcategory	Range of Validity	Source(s)
Cooling tower	($): 32.17 × flow (gpm) + 234,335	Ironmaking Integrated steelmaking Integrated and stand-alone hot forming Non-Integrated steelmaking and hot forming	500 to 60,000 gpm	Capital cost survey, vendor information
Recycle pump station	($): 11.58 × flow (gpm) + 123,145	Ironmaking Integrated steelmaking Integrated and stand-alone hot forming Non-Integrated steelmaking and hot forming	6,900 to 35,000 gpm	Capital cost survey, vendor information
Lime feed system	($): 50.591 × flow (gpm) + 27,665	Sintering Ironmaking Steel finishing	104 to 1,390 gpm	Vendor information
Inclined plate clarification	($): 508.3 × flow (gpm) + 33,538	Steel finishing	50 to 400 gpm	Capital cost survey, vendor information

Table 10-16

Iron and Steel Operating and Maintenance (O&M) Cost Equations

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Biological nitrification (chemicals include soda ash, phosphoric acid, polymer, and defoaming agent)	Electrical ($/yr): 810 × flow (gpm) Chemicals ($/yr): 639 × flow (gpm) O&M labor ($/yr): DPY × HPD × $29.67/hr = 260,000 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): 60,000 Sludge disposal ($/yr): cost included with belt filter O&M	Cokemaking	50 to 500 gpm
Biological treatment upgrade	Electrical ($/yr): 288 × flow (gpm) Chemicals ($/yr): — Soda ash: 164 × flow (gpm) — Phosphoric acid: 19.4 × flow (gpm) O&M labor ($/yr): 0, upgrade includes costs for automated control systems, no added O&M is expected Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost	Cokemaking	30 to 500 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Tar removal	Electrical ($/yr): (0.0158 × flow (gpm) + 2.3551)kW × HPD × DPY × $0.047/kWh Chemicals ($/yr): 0 O&M labor ($/yr): 0.5 hrs/day × DPY × $29.67/hr = 5,415 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost	Cokemaking	50 to 200 gpm
Flow equalization tank (prior to ammonia stripping and biological nitrification)	Electrical (b) ($/yr): (0.092 HP/gpm × flow (gpm)) × 0.7456 kW/HP × DPY × HPD × $0.047/kWh where flow is ammonia still flow or biological treatment system flow (as applicable) Chemicals ($/yr): 0 O&M labor ($/yr): DPY × 1.5 hrs/day × $29.67/hr = 16,250 Maintenance equipment and vendors (c) ($/yr): 5,534 × (flow (gpm)/100 gpm) where flow is ammonia still flow or biological treatment system flow (as applicable)	Cokemaking	250,000 to 1,250,000 gallons

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Free and fixed ammonia still	Electrical ($/yr): 82 x flow (gpm) Steam ($/yr): — 1,581 x flow (gpm) —3,215 x flow (gpm) Chemicals ($/yr): — Caustic soda: 1,404 × flow (gpm) O&M labor ($/yr): DPY × 6 hrs/day x $29.67/hr = 70,000 Maintenance equipment and vendors ($/yr) (a): 0.06 × investment cost Sampling/monitoring ($/yr): DPY × $52/day = 18,980	Cokemaking	40 to 400 gpm
Clarification of activated sludge	Electrical, chemical, O&M labor, maintenance equipment, and vendor costs included with biological nitrification O&M	Cokemaking	20 to 90 ft diameter
Heat exchanger	Electrical (b) ($/yr): (0.0746 × flow (gpm)) kWh × HPD × DPY × $0.047/kWh O&M labor (d) ($/yr): 1 hr/wk × 52 wk/yr × $29.67/hr = 1,540 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost	Cokemaking	20 to 300 gpm of hot water flow; Influent temp: 140°F; Effluent temp: 80°F

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Sludge thickening of activated sludge and metal hydroxides	Electrical (b) ($/yr): (Flow (gpm)/35 × 5) × 0.7456 kW/HP × HPD × DPY × $0.047/kWh where flow is 4% of flow to the clarifier Chemicals ($/yr): (costs included with biological nitrification for activated sludge; costs included with chemical precipitation and clarification for metal hydroxides) O&M labor ($/yr): DPY/2 × 1 hour/day × $29.67/hr = 5,415 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Sludge disposal ($/yr): (applies to PSES-3 and PSES-4 only, cokemaking subcategory; cost included with belt filter O&M)	Cokemaking Steel finishing	0.5 to 1,390 gpm
Belt filter press	Electrical, chemical, O&M labor, maintenance equipment, and vendor costs included with biological nitrification O&M Sludge disposal ($/yr): 24 lbs/day/gpm × flow (gpm) × DPY × $0.0025/lb	Cokemaking	4 to 14 tons/day of wet sludge

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Cyanide precipitation (includes sludge thickener and filter press O&M costs; chemicals include ferric sulfate, sulfuric acid, polymer, and sodium hydroxide)	Electrical ($/yr): 6.67 × flow (gpm) Chemicals ($/yr): 989.75 × flow (gpm) (all chemicals) O&M labor ($/yr): 1,343.6 × flow (gpm) Maintenance equipment and vendors ($/yr): 250 × flow (gpm) Monitoring ($/yr): 2,000	Cokemaking	40 to 400 gpm
Sludge thickening for iron-cyanide sludge	All O&M costs are included with cyanide precipitation	Cokemaking	40 to 400 gpm
Plate and frame filter press	Electrical ($/yr): 1,200 Chemicals ($/yr): (costs are included in O&M for cyanide precipitation for cokemaking; costs are included in O&M for chemical feed systems for steel finishing) O&M labor ($/yr): $29.67/hr x 3 hrs/day x DPY = 32,490 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost	Cokemaking Steel finishing	40 to 400 gpm
Polymer feed system	All O&M costs are included where polymer is used.	Cokemaking Ironmaking Integrated steelmaking Steel finishing	40 to 1,390 gpm
Ferric sulfate feed system	All O&M costs are included with cyanide precipitation.	Cokemaking	40 to 400 gpm
Sodium hydroxide feed system	All O&M costs are included where sodium hydroxide is used.	Cokemaking Ironmaking Integrated steelmaking	40 to 400 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Sulfuric acid feed system	All O&M costs are included where sulfuric acid is used.	Ironmaking Integrated Steelmaking	40 to 400 gpm
Breakpoint chlorination	Electrical (b) ($/yr): 90.6 × flow (gpm) Chemicals (e) ($/yr): — Sodium hypochlorite: 6.43 × flow (gpm) × (mg/L CN × 8.5 + mg/L NH4 × 7.4) — Sodium hydroxide: 7.9 × flow (gpm) — Sulfuric acid: 83.6 × flow (gpm) — Sodium bisulfite: 1.82 × flow (gpm) × (mg/L CN × 1.7 + mg/L NH4 × 1.5) O&M labor ($/yr): 1 hr/shift × 3 shifts/day × DPY × $29.67/hr = 32,490 Maintenance equipment and vendors ($/yr): 250 × flow (gpm) Monitoring ($/yr): 2,000	Cokemaking	88 to 2,340 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Multimedia filtration	Electrical (b) ($/yr): [(0.0504 × flow (gpm) + 1.0139] × 8,760 hrs/yr × $0.047/kWh Chemicals ($/yr): 0 O&M Labor ($/yr): 1.5 hrs/day × DPY × $29.67/hr = 16,240 Maintenance equipment and vendors ($/yr) (a): 0.06 × investment cost Monitoring ($/yr): NA	Cokemaking Sintering Ironmaking Integrated steelmaking Integrated and stand-alone hot forming Non-Integrated steelmaking and hot forming Other operations	< 50 gpm to >5,200 gpm
Granular activated carbon	Electrical (b) ($/yr): 9.6 × flow (gpm) Chemicals ($/yr): NA O&M labor ($/yr): 8.13 × flow (gpm) Maintenance equipment and vendors ($/yr): 1228.6 × flow (gpm) Monitoring ($/yr): 60 × flow (gpm)	Cokemaking	88 to 2,340 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Chemical precipitation	Electrical (b) ($/yr): [(0.0934 × flow (gpm)) + 0.7763]HP × 0.7456 kW/HP × DPY × HPD × $0.047/kWh Chemicals ($/yr): — Lime flow (gpm) × 1,440 min/day × 0.0004 lbs/gal × DPY × $0.035/lb (ironmaking, steel finishing) — NaOH flow (gpm) × 1,440 min/day × 0.0033 lbs/gal × DPY × $0.15/lb (integrated steelmaking) — Polymer flow (gpm) × 1,440 min/day × 0.00005 lbs/gal × DPY × $0.20/lb (ironmaking, integrated steelmaking) DPY × flow (gpm) × 1,440 min/day × 0.000018 lbs/gal × $0.20/lb (steel finishing) O&M labor ($/yr): 3 shifts/day × 4 hrs/shift × DPY × $29.67/hr = 29,955 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): NA	Ironmaking Integrated steelmaking Steel finishing	104 to 1,390 gpm

<u>Abbreviations</u>:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Breakpoint chlorination of blast furnace and sintering wastewater	Electrical (b) ($/yr): 79.8 × flow (gpm) Chemicals ($/yr): — Sodium hypochlorite 0.0027 lbs/gal × flow (gpm) × 1,440 min/day × DPY × 1.47 $/lb — Sulfuric acid 0.0006 lbs/gal × flow (gpm × 1,440 min/day × DPY × 0.043 $/lb — Sodium bisulfite (f) (0.00054 lbs/gal) × flow (gpm) × 1440 min/day × DPY × (104 g/mol $NaHSO_3$/ 81 g/mol HSO_3) × $0.325/lb O&M labor ($/yr): 1 hr/shift × 3 shifts/day × DPY × $29.67/hr = $32,490 Maintenance Equipment and Vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): 2,000	Ironmaking	104 to 1,390 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Vacuum filtration	Electrical (b) ($/yr): [(0.0002 × (sludge generation (lbs/day)) + 3.491]kW × DPY × HPD × $0.047/kWh Chemicals ($/yr): 234 lbs/day × DPY × $0.21/lb (diatomaceous earth) = 17,936 O&M labor ($/yr): DPY × 3 shifts/day × 4 hr/shift × $29.67/hr = 32,489 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): 0	Ironmaking	104 to 1,390 gpm
Carbon dioxide injection system	Electrical (b) ($/yr): 181 kWh/day x DPY x $0.047/kWh = 3,105 Chemicals ($/yr): 0.5 lbs/day/gpm x flow (gpm) x $0.081/lb (carbon dioxide) O&M labor ($/yr): DPY × 2 hr/day × 4 hr/shift × $29.67/hr = 21,659 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): 0	Integrated steelmaking	< 2,400 to > 5,600 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Cooling tower	Electrical (b) ($/yr): [((0.035 × flow (gpm))/3.5 gpm/ft) + ((flow (gpm) × 40 feet)/(3,960 × 0.75))] × 0.7456kW/HP × DPY × HPD × $0.047/kWh Chemicals (g) ($/yr): — Biocide: $4.00 × cooling tower flow (gpm) × 10 minutes/1,000 × DPY/2 — Scale inhibitor: 0.02 lbs/day/gpm × cooling tower flow (gpm) × DPY × $0.19/lb O&M labor ($/yr): ((1.5 hrs/day × DPY × $29.67/hr) + (4 persons × 40 hrs/person × $29.67/hr)) = 20,990 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): 0	Ironmaking Integrated steelmaking Integrated and stand-alone hot forming Non-Integrated steelmaking and hot forming	500 to 60,000 gpm

<u>Abbreviations</u>:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Recycle pump station	Electrical (b) ($/yr): (0.0631 × flow (gpm) + 2.0227)HP × 0.7456 kW/HP × HPD × DPY × $0.047/kWh Chemicals ($/yr): 0 O&M labor ($/yr): 40 hrs/yr × $29.67/hr = 1,191 Maintenance equipment and vendors ($/yr): 0.06 × investment cost Monitoring ($/yr): 0	Integrated and stand-alone hot forming Non-Integrated steelmaking and hot forming	6,900 to 35,000 gpm
Lime feed system	All O&M costs are included in chemical precipitation	Sintering Ironmaking Steel finishing	104 to 1,390 gpm

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-16 (continued)

Equipment	Cost Equation	Applicable Subcategory	Range of Validity
Inclined plate clarification	Electrical (b) ($/yr): 0 Chemicals ($/yr): 0 O&M labor ($/yr): DPY/2 × 1 hr × $29.67/hr = 5,415 Maintenance equipment and vendors (a) ($/yr): 0.06 × investment cost Monitoring ($/yr): 0	Steel finishing	50 to 400 gpm

Notes:

(a) Annual maintenance equipment and vendor costs approximately 6% of investment cost per Perry's Chemical Engineers Handbook, Sixth Edition (Reference 10-3).
(b) Electrical costs calculated from equipment horsepower and operational period.
(c) Assumes annual replacement of recirculation pump.
(d) Estimated from information provided by vendor.
(e) Chemical costs for sodium hypochlorite and sodium bisulfite based on stoichiometric requirements. Sodium hydroxide and sulfuric acid requirements based on sample preservation data.
(f) Bisulfite concentration based on stoichiometric requirement plus 20% excess.
(g) Typical scale inhibitor and biocide concentrations estimated by chemical vendor.
NA - Not applicable.

Abbreviations:

HPD - 24 hours of operation per day.
DPY - 365 days of operation per year.

Table 10-17

Summary of Incremental Costs for the Cokemaking Subcategory (in millions of 1997 dollars)

Option	Investment Cost	Operating and Maintenance Cost	One-Time Cost
BAT-1	26.0	4.6	0.4
BAT-3	67.5	7.2	0.4
PSES-1	6.1	1.5	0.1
PSES-3	23.4	5.0	0.3

Table 10-18

Summary of Incremental Costs for the Ironmaking and Sintering Subcategories (in millions of 1997 dollars)

Options	Investment Cost	Operating and Maintenance Cost	One-Time Cost
BAT-1 and PSES-1 (ironmaking subcategory)	52.6	7.8	0.4
Sintering subcategory	11.0	1.3	0

Table 10-19

Summary of Incremental Costs for the Integrated Steelmaking Subcategory (in millions of 1997 dollars)

Options	Investment Cost	Operating and Maintenance Cost	One-Time Cost
BAT-1 and PSES-1	43.4	8.4	0.3

Table 10-20

Summary of Incremental Costs for the Integrated and Stand-Alone Hot Forming Subcategory (in millions of 1997 dollars)

Option	Investment Cost	Operating and Maintenance Cost	One-Time Cost
Carbon and Alloy Steel Segment			
BAT-1	141.3	19.7	0.2
PSES-1	0.3	0.1	0.1
Stainless Segment (a)			
PSES-1	0.3	0.1	0.1

(a) No sites reported direct discharge of wastewater within the stainless segment.

Table 10-21

Summary of Incremental Costs for the Non-Integrated Steelmaking and Hot Forming Subcategory (in millions of 1997 dollars)

Option	Investment Cost	Operating and Maintenance Cost	One-Time Cost
Carbon and Alloy Steel Segment			
BAT-1	44.4	5.2	1.9
PSES-1	10.8	1.1	0.4
Stainless Steel Segment			
BAT-1	4.0	0.5	0.1
PSES-1	1.0	0.1	0.1

Table 10-22

Summary of Incremental Costs for the Steel Finishing Subcategory (in millions of 1997 dollars)

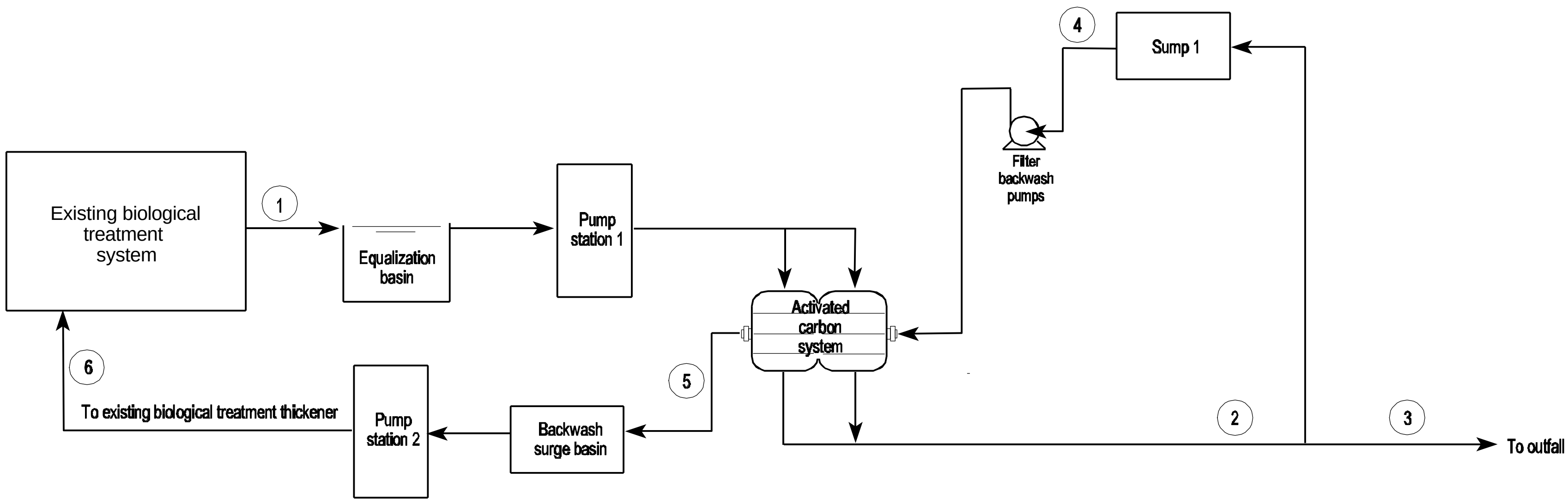
Option	Investment Cost	Operating and Maintenance Cost	One-Time Cost
Carbon and Alloy Steel Segment			
BAT-1	21.4	4.8	34.5
PSES-1	4.5	1.0	12.6
Stainless Steel Segment			
BAT-1	6.0	1.6	36.9
PSES-1	1.0	0.4	6.0

Table 10-23

Summary of Incremental Costs for the Other Operations Subcategory (in millions of 1997 dollars)

Option	Investment Cost	Operating and Maintenance Cost	One-Time Cost
Direct-Reduced Ironmaking Segment			
BPT	(a)	(a)	(a)
Forging Segment			
BPT	0.1	0.02	0.03

(a) Data aggregation or other masking techniques are insufficient to protect confidential business information.

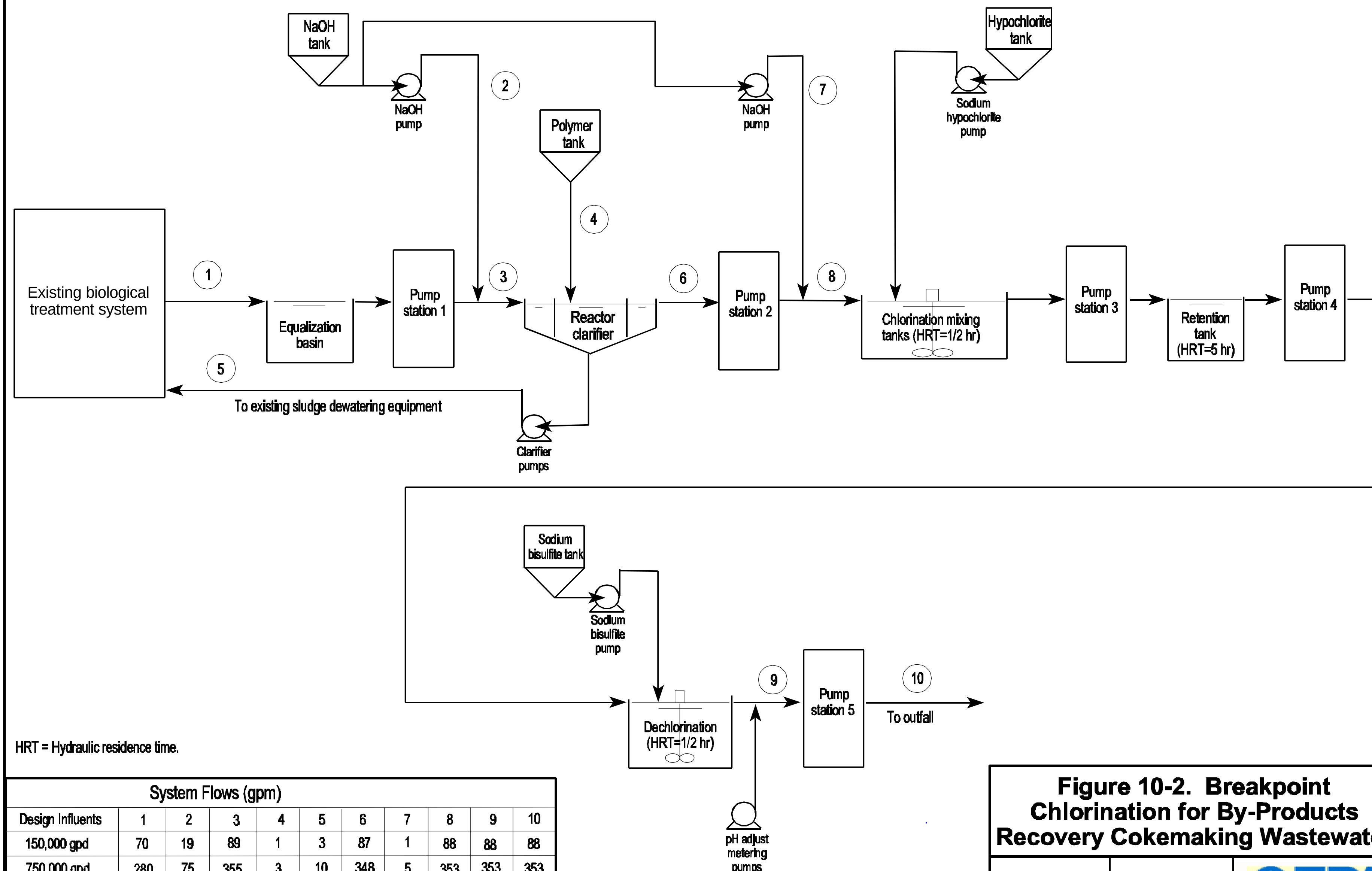


System Flows (gpm)

Design Influents	1	2	3	4	5	6
100,000 gpd	70	70	52	9 (avg) 225 (max)	9 (avg) 225 (max)	9
400,000 gpd	280	280	250	15 (avg) 350 (max)	15 (avg) 350 (max)	15
2,700,000 gpd	1875	1875	1625	125 (avg) 1500 (max)	125 (avg) 1500 (max)	125

Figure 10-1. Activated Carbon System for By-Products Recovery Cokemaking Wastewater

GAC	10/27/00	EPA

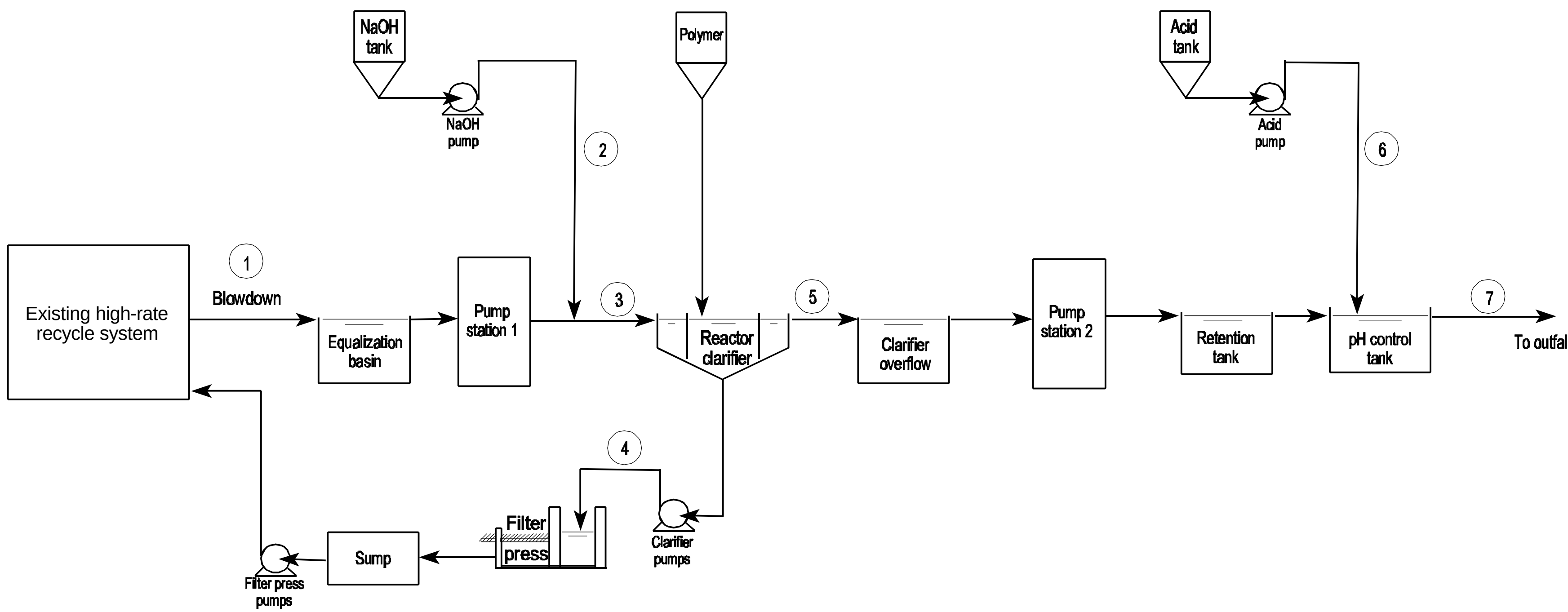


System Flows (gpm)

Design Influents	1	2	3	4	5	6	7	8	9	10
150,000 gpd	70	19	89	1	3	87	1	88	88	88
750,000 gpd	280	75	355	3	10	348	5	353	353	353
2,000,000 gpd	1875	500	2375	5	70	2310	30	2340	2340	2340

Figure 10-2. Breakpoint Chlorination for By-Products Recovery Cokemaking Wastewater

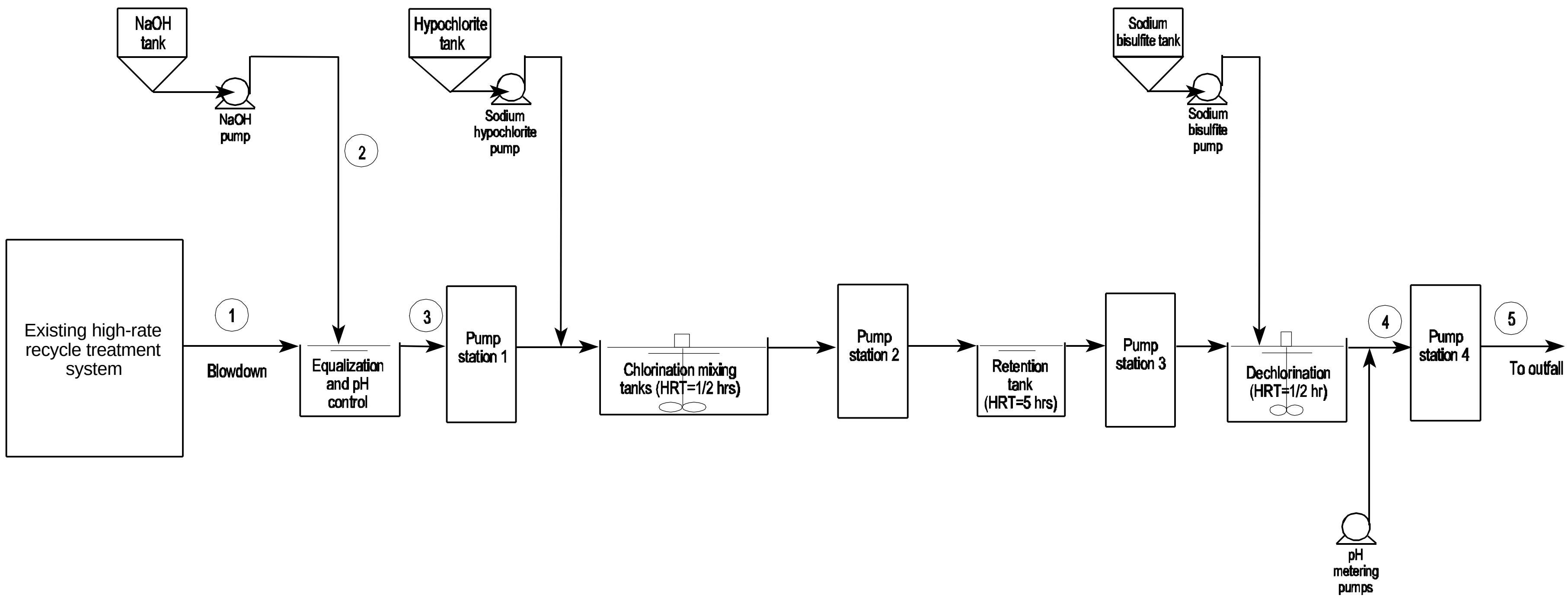
COKE	10/20/00	EPA



System Flows (gpm)							
Design Influents	1	2	3	4	5	6	7
150,000 gpd	105	30	135	5	130	2	132
750,000 gpd	525	140	665	20	645	10	655
2,000,000 gpd	1390	370	1760	40	1720	30	1750

Figure 10-3. Blowdown Metals Precipitation for Ironmaking Wastewater

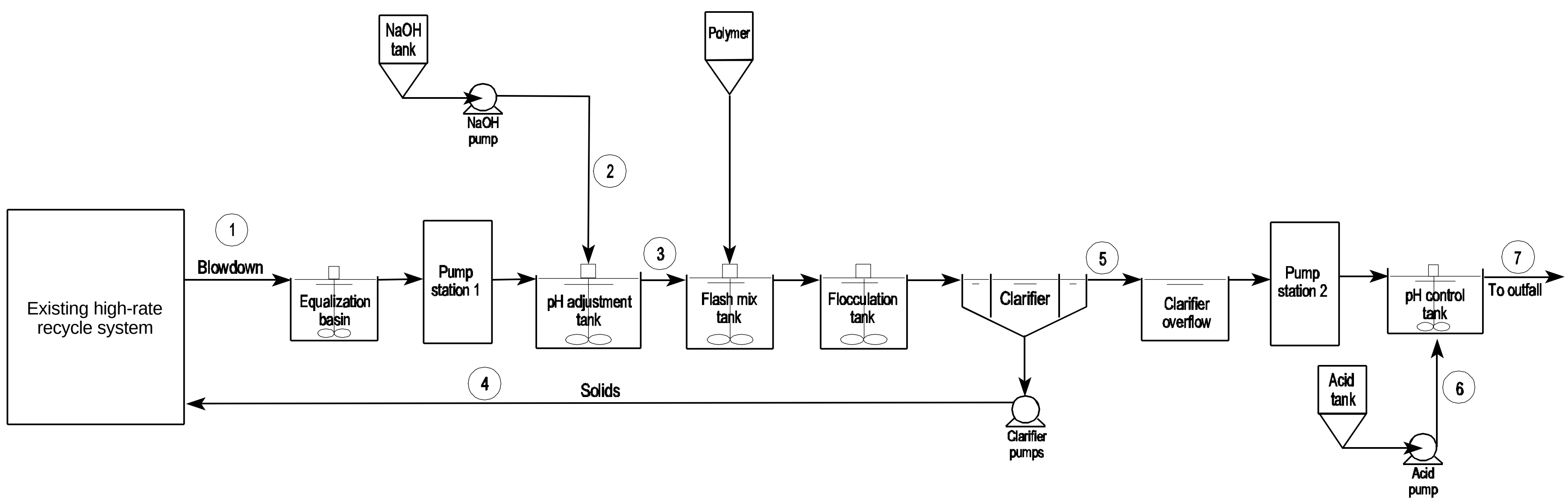
IRNMAK	10/20/00	EPA



System Flows (gpm)					
Design Influents	1	2	3	4	5
150,000 gpd	105	5	110	110	110
750,000 gpd	525	10	535	535	535
2,000,000 gpd	1390	25	1415	1415	1415

Figure 10-4. Breakpoint Chlorination for Ironmaking Wastewater

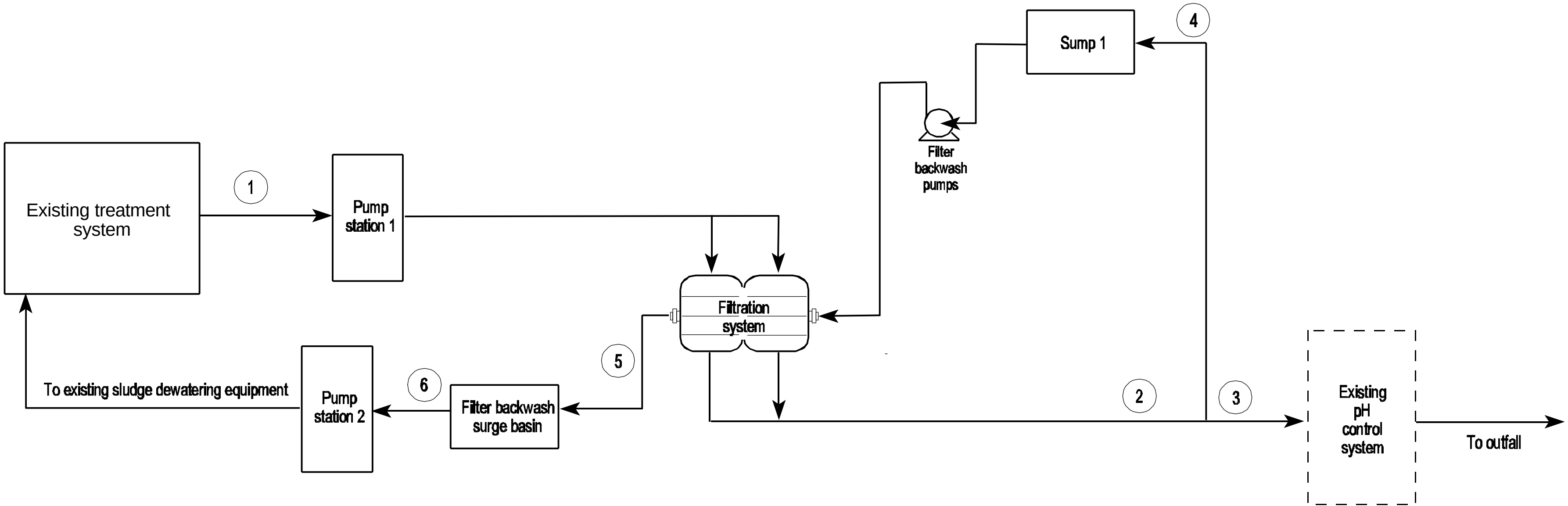
IRNMAK	10/20/00	EPA



System Flows (gpm)							
Design Influents	1	2	3	4	5	6	7
150,000 gpd	105	30	135	5	130	2	132
750,000 gpd	525	140	665	20	645	10	655
2,000,000 gpd	1390	370	1760	40	1720	30	1750

Figure 10-5. Blowdown Metals Precipitation for Steelmaking Wastewater

STEEL	10/20/00



System Flows (gpm)

Design Influents	1	2	3	4	5	6
150,000 gpd	105	105	95	10 (avg) 226 (max)	10 (avg) 226 (max)	10
500,000 gpd	350	350	333	17 (avg) 402 (max)	17 (avg) 402 (max)	17
2,000,000 gpd	1390	1390	1265	125 (avg) 1500 (max)	125 (avg) 1500 (max)	125
7,500,000 gpd	5200	5200	4870	330 (avg) 1500 (max)	330 (avg) 1500 (max)	330
20,000,000 gpd	13900	13900	13230	670 (avg) 3000 (max)	670 (avg) 3000 (max)	670

Figure 10-6. Filtration of Wastewater from All Subcategories

FILT	10/22/00	EPA

SECTION 11

POLLUTANT LOADINGS

This section presents annual pollutant loadings and removal estimates for the iron and steel industry for each regulatory option considered for the final rule for each subcategory. (Regulatory options are described in Section 9.) EPA estimated the pollutant loadings and removals from iron and steel sites to evaluate the effectiveness of the treatment technologies, to estimate benefits gained from removing pollutants discharged from sites, to estimate costs to achieve such reductions, and to evaluate the cost-effectiveness of the regulatory options in reducing the pollutant loadings. Key terms for pollutant loadings and removals are defined below:

- Baseline loadings - Pollutant loadings, in pounds per year (lbs/yr), in iron and steel wastewater being discharged to surface water or to publicly owned treatment works (POTWs) in 1997.

- Treated loadings - Also referred to as post-compliance loadings, they are the estimated pollutant loadings in iron and steel wastewater after implementation of the promulgated rule or regulatory option. EPA calculated these loadings assuming that all iron and steel sites would operate their wastewater treatment and pollution prevention technologies to achieve the option model LTAs and model PNF.

- Pollutant removals - The difference between baseline loadings and treated loadings for each regulatory option.

This section discusses the methodology that EPA used to estimate pollutant loadings and presents the resultant estimated baseline and treated loadings and pollutant removals as follows:

- Section 11.1 discusses the data sources that EPA used to estimate pollutant loadings and removals;

- Section 11.2 discusses the general methodology EPA used to estimate baseline pollutant loadings;

- Section 11.3 discusses the general methodology EPA used to estimate treated pollutant loadings;

- Section 11.4 discusses the general methodology EPA used to estimate pollutant removals;

- Section 11.5 discusses how the costing analysis affects the loadings analysis;

- Section 11.6 presents an example calculation of the baseline and treated pollutant loadings and pollutant removals;

- Sections 11.7 through 11.14 present the specific methodologies used to estimate pollutant loadings and the resulting pollutant removals for each subcategory; and

- Section 11.15 presents the references used in this section.

11.1 Sources and Use of Available Data

EPA used data from several sources to estimate baseline and treated pollutant loadings. These sources included:

- EPA site visits;

- EPA sampling episodes at iron and steel sites;

- EPA requests for additional data after proposal;

- Industry responses to the U.S. EPA Collection of 1997 Iron and Steel Industry Data, also referred to as the detailed survey;

- Industry responses to the U.S. EPA Collection of 1997 Iron and Steel Industry Data (Short Form), also referred to as the short survey;

- Industry responses to the U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data, also referred to as the Analytical & Production Survey; and

- Publicly available National Pollutant Discharge Elimination System (NPDES) and pretreatment permit application data.

Section 3 discusses data sources used to develop this regulation in detail.

EPA used flow rate data from the industry surveys and pollutant concentration data from the sources listed above to calculate the pollutant loadings. EPA defined the types of pollutant concentration data as follows:

- Survey Summary Data - Industry self-monitoring data supplied by sites in the detailed and short surveys. These data are a 1997 annual average.

- Industry Self-Monitoring Data (ISMD) - Self-monitoring data (typically daily monitoring report data) submitted with the Analytical and Production Survey, detailed survey, or short survey, sent as a result of EPA's request subsequent to survey submittal, or submitted during a site visit.

- Sampling Data - Data collected during EPA's wastewater sampling program.

- Permit Application Data - Publicly available NPDES and pretreatment permit application data. These data were only used where necessary (i.e., if self-monitoring or sampling data did not sufficiently represent operating conditions or if no other data were available for the site).

Depending on the source and type of data, the Agency treated pollutant concentration data below the sample detection limit differently. For EPA sampling data, when concentrations were below the sample detection limit, EPA used the reported sample detection limit as the concentration for that pollutant. For ISMD, when concentrations were below the sample detection limit, the Agency used what the site reported as the sample detection limit. When sites provided survey summary data, EPA used the average concentrations that the sites submitted, which could have been calculated by several methods. Of those sites that submitted survey summary data, 26 percent used the method detection limit as the concentration for that pollutant; 26 percent used the sample detection limit; 7 percent used one-half the method detection limit; 3 percent used one-half the sample detection limit; and 38 percent used zero. Using zero as the concentration for the pollutant estimated the minimum amount of the pollutant, and using the method or sample detection limit estimated the maximum amount.

11.2 Methodology Used to Estimate Baseline Pollutant Loadings

Using industry survey responses, EPA determined which subcategories and segments apply to each site based on the manufacturing operations in place. EPA calculated the baseline pollutant loadings for a specific facility using the production-normalized process discharge flow rate for each manufacturing operation and the concentration of pollutants in its effluent obtained from the data sources described in Section 11.1. Section 11.2.1 through 11.2.6 provides additional detail regarding the calculations of baseline pollutant loadings.

However, EPA did not have data for every facility to calculate baseline pollutant loadings. In some cases, EPA did not have data for all pollutants of concern (POCs). In other cases, the data EPA had did not represent iron and steel industry wastewater only. In addition, some facilities commingle iron and steel wastewater with storm water or ground water prior to monitoring for compliance; pollutant concentration data from these facilities do not represent baseline pollutant concentrations from the iron and steel manufacturing process. In all of these cases, facility-supplied data were insufficient for use in estimating baseline loadings. As a surrogate for site-specific baseline pollutant concentrations, EPA averaged available baseline concentrations from facilities in a subcategory or segment and used this average to estimate pollutant concentrations where site-specific data were not available. Section 11.2.2 describes

EPA's methodology for calculating subcategory-specific average baseline pollutant concentrations in detail.

11.2.1 Determination of Site-Specific Average Baseline Pollutant Concentrations

To calculate baseline concentrations, if a site provided both ISMD and survey summary data for the same pollutant, then the Agency used the ISMD and excluded the survey summary data because the survey summary data were an average of pollutant concentration data for the entire year calculated using a variety of methods described in Section 11.1. If a site had sampling data in addition to ISMD for the same pollutant, then EPA first averaged the sampling data and ISMD for the pollutant separately, and then averaged the resulting data averages together.[1] If only sampling data were available, then EPA used the sampling data average. EPA used permit application data only when no other data were available.

When sites provided ISMD for 1997[2], the Agency calculated an arithmetic average of all the data for the loadings analysis. When sites provided survey summary data (where results were already averaged), the Agency used those data. For permit application data, sites monitored multiple times for some pollutants but only one time for other pollutants. EPA used the permit application data as reported.

11.2.2 Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

After calculating site-specific baseline concentrations for each pollutant, EPA calculated a single set of average baseline pollutant concentrations for each subcategory or segment.[3] To calculate the subcategory-specific average baseline pollutant concentrations, EPA averaged applicable site-specific average baseline concentration data for all sites together in each subcategory or segment, except conventional pollutants. For conventional pollutants, the Agency calculated separate subcategory-specific average baseline pollutant concentrations for direct and indirect dischargers because the POTW treats conventional pollutants; therefore, the concentrations for conventional pollutants for indirect dischargers would be expected to be higher than for direct dischargers. If no data were available for conventional pollutants for either direct or indirect dischargers, then EPA used the same average baseline pollutant concentration

[1]When calculating average pollutant concentrations using both sampling data and ISMD, EPA did not eliminate any sampling data or industry self-monitoring data prior to averaging them, even if they were duplicate samples (from the same day and sampling point).

[2]EPA used data that were representative of the sites' treatment system in 1997. If a site provided data from a year other than 1997, EPA used the data only if it was representative of the treatment system in 1997 (e.g., if the site had any treatment system upgrades after 1997, the data from after 1997 were not used).

[3]For cokemaking, EPA calculated a separate set of subcategory-specific average baseline pollutant concentrations for sites with ammonia stills only and for sites with ammonia stills and biological treatment. For ironmaking and sintering, EPA calculated a separate set of subcategory-specific average baseline pollutant concentrations for sites with blast furnace wastewater only and sites with commingled blast furnace and sintering wastewater.

for both types of dischargers. The average baseline pollutant concentrations were used to calculate the baseline pollutant loadings when no data for a POC were available for a site. For example, if no cokemaking data were available for total cyanide for a site, EPA calculated the baseline pollutant loading for total cyanide for that site using the average baseline concentration for total cyanide, which in turn was calculated using all the applicable total cyanide data submitted by cokemaking facilities.

For some pollutant parameters, EPA performed a logic check to ensure that average concentrations of pollutants derived from different datasets or data transfers did not violate certain rules for bulk parameters. For example, many sites had industry self-monitoring data for oil and grease (measured as hexane extractable material), or O&G; however, they did not have industry self-monitoring data for total petroleum hydrocarbons (measured as silica gel treated-hexane extractable material), or TPH. Before using the subcategory-specific average baseline concentration for TPH to fill the gap in the data, EPA compared it to the site's data for O&G. In some cases, the subcategory-specific average baseline concentration for TPH was greater than the site's concentration for O&G, which would be illogical because TPH is a subset of O&G. In these cases, EPA used the site's concentration for O&G as the concentration for TPH. The data logic checks for each site were the following rules:

- Phenol could not have a concentration higher than total phenols;
- Amenable cyanide or weak acid dissociable (WAD) cyanide could not have a concentration higher than total cyanide;
- TPH could not have a concentration higher than O&G; and
- Hexavalent chromium could not have a concentration higher than total chromium.

If one of the above rules was violated, EPA adjusted one concentration, always deferring to the site's data. EPA encountered the following data conflicts and resolved them as shown below.

Conflict	EPA Action
The site-specific concentration for a bulk parameter is less than the transferred average baseline concentration for a pollutant within the bulk parameter.	Use the site-specific concentration as the baseline concentration for both the bulk parameter and the pollutant within the bulk parameter.
The site-specific concentration for a pollutant within a bulk parameter is greater than the transferred average baseline concentration for a bulk parameter.	Use the site-specific concentration as the baseline concentration for both the pollutant within the bulk parameter and the bulk parameter.

Conflict	EPA Action
From the EPA sampling data, the site concentration for total recoverable phenols is less than the site concentration for phenol (no industry self-monitoring data are available for either pollutant).	The method for phenol is a gas chromatograph/mass spectrometry (GC/MS) method. The method for total recoverable phenols is a colorimetric method (Reference 10-1). The GC/MS method is expected to be more accurate than the colorimetric method; therefore, use the concentration of phenol for both parameters.

11.2.3 Cotreatment of Wastewater

Some sites cotreat their wastewater from multiple subcategories, as discussed in Section 10. Cotreatment is any site treatment system that receives wastewater from more than one subcategory. For sites that cotreat their wastewater, EPA used the following methodology to determine which baseline concentration data are appropriate for each subcategory:

- EPA determined if cotreatment outfall data and/or subcategory-specific internal monitoring data are available. Cotreatment outfall data are pollutant data from a sampling point after the cotreatment system. Subcategory-specific internal monitoring data are pollutant data from a sampling point after an in-process treatment system that treats the subcategory-specific wastewater only, and before end-of-pipe cotreatment.

- If no cotreatment or subcategory-specific data were available for a facility, then EPA used the subcategory-specific average baseline pollutant concentrations for the facility.

- If dilution water entering the cotreatment system and subcategory-specific treatment system was greater than 10 percent, then EPA did not use the site data because they do not represent treated effluent for that subcategory. EPA used the subcategory-specific average baseline pollutant concentrations for that site.

- If wastewater sources from other subcategories exceeded 10 percent of the influent for a facility in a particular subcategory, then EPA did not use the cotreatment outfall data. EPA similarly used the subcategory-specific average baseline pollutant concentrations for that site.

If the cotreatment outfall data were not available or not used for the above reasons, then EPA used the subcategory-specific internal monitoring data. The Agency used these data, regardless of the additional treatment at the cotreatment system, to determine if any costs for treatment upgrades to the subcategory-specific wastewater treatment system were needed to meet the limitations. As an example, one site has both cotreatment and internal monitoring data, and the cotreatment system is expected to remove considerable amounts of POCs. The site's cotreatment data are not used because 34% of the wastewater is dilution water. This site is estimated to incur costs to upgrade its subcategory-specific wastewater treatment system, not its cotreatment system for the reasons described in Section 10. Therefore, the internal monitoring data are used because the limitations would apply only to the effluent from the subcategory-specific wastewater treatment system.

11.2.4 POCs Included in the Pollutant Loadings Analysis

EPA estimated pollutant loadings for only a subset of the POCs identified in Section 7. From the list of POCs in Section 7, EPA eliminated pollutants that were never detected in the baseline effluent for any site, by subcategory and segment. EPA used data from its sampling program and industry self-monitoring data to determine which POCs were never detected in the effluent; however, for many POCs (particularly organic compounds), the only available data were from EPA's sampling program. EPA excluded undetected POCs because the pollutant removals calculated would be zero (i.e., EPA did not calculate or assume any pollutant removals less than the detection limit). Table 11-1 lists the POCs that were not detected in the effluent at any site for each subcategory and segment. In addition, EPA eliminated POCs from the pollutant loadings analysis that did not pass certain influent editing criteria discussed in Section 14. Table 11-2 lists these pollutants.

For the cokemaking and integrated steelmaking subcategories, EPA also considered in its pollutant loadings and removals analyses the percent removals for POCs by the model BAT/PSES treatment sites. (Section 14 discusses selection of model BAT/PSES treatment facilities.) These percent removals show the extent to which POCs were being removed by the treatment technology. For some POCs, the BAT/PSES treatment facilities showed no removals (i.e., the percent removal was zero or negative). Furthermore, if a particular POC showed no removal at all the BAT/PSES treatment facilities, then EPA concluded that the model treatment technology does not remove the POC. Therefore, for these POCs, EPA set the treated pollutant loadings equal to the baseline pollutant loadings to reflect the fact that the pollutant removals would be zero. See the memorandum titled "Percent Removal Estimates and Their Effect on LTA and Pollutant Removal Calculations", document number IS10849 in Section 14.7 of the rulemaking record for additional detail regarding use of this criteria in the loadings analyses. Section 12 and 14 provide more information on how the percent removals were calculated.

For the remaining subcategories, EPA did not consider percent removals as a component of the loadings analyses. See document number IS10849 in Section 14.7 of the rulemaking record for an assessment of the impact that the percent removals would have had on the estimated pollutant removals for the final rule. The impacts are not significant and they would not have changed any of EPA's decisions for the final rule.

11.2.5 Sites and Data Used in the Pollutant Loadings Analysis

EPA estimated both baseline and treated pollutant loadings for the iron and steel industry for the base year 1997. The Agency included sites (or operations) that operated during the 1997 calendar year in the cost and loadings analyses, if the site operated at least one day during the 1997 calendar year. Even if a site (or operation) shut down after 1997, it was retained in the costing and pollutant loadings analyses, except for one site. This site shut down operations after 1997 and EPA was unable to verify costing assumptions and the site's reported high flow; therefore, this site was removed from the costing and loadings analyses, but its data were used to calculate subcategory-specific average baseline pollutant concentrations for some subcategories. Also, if a site (or operation) commenced after 1997, EPA did not include the site (or operation) in the costing or pollutant loadings analyses. See Section 3.1 for additional information regarding EPA's use of 1997 as the base year for its analyses for this rule. Furthermore, if a site did not discharge wastewater to surface water or a POTW in 1997 (e.g., recycles all of its wastewater), then EPA excluded the site from the pollutant loadings analysis. See Table 5-3 in Section 5 for additional information regarding the number of zero or alternative discharging sites.

For some sites, 1997 data did not represent normal operating conditions; therefore, data for alternate years were used according to what the sites specified as their representative time period. For example, EPA was aware of several sites that had operated during only part of 1997 because of strikes, shut-downs, or start-ups. For these sites, EPA used production, analytical, and flow rate data from years that the sites indicated were representative of normal operations. However, if sites installed or significantly altered wastewater treatment systems either during or after 1997, EPA used the data that represented their 1997 wastewater treatment configuration. Also, at least one site changed its discharging status after 1997; EPA used the site's discharge status in the base year 1997 in its analyses for the reasons discussed in Section 3.1.

EPA was aware of a unique case in which a site's industry self-monitoring data from 1997 conflicted with industry self-monitoring data from 1996 by an order of magnitude. EPA contacted the site and, at their suggestion, used three years of analytical data to better represent the treatment system performance.

11.2.6 Baseline Pollutant Loadings Calculation

As noted above, baseline pollutant loadings represent the current loadings for each site before implementation of the model technology. In the industry survey, most sites reported flow rates and some sites reported baseline concentration data. Sites reported flow from operations in either gallons per minute or gallons per day, along with the corresponding days per year and hours per day, as necessary. EPA used the flows and productions as reported by the sites to calculate the PNF. For pollutant concentrations, EPA used the analytical data submitted by each site. If no data were submitted for a site or a pollutant, the subcategory-specific average baseline pollutant concentrations for the subcategory or segment were used. For each pollutant, EPA estimated the baseline pollutant loadings for each site's operations in a subcategory, using Equation 11-1:

$$\text{BL Load} = \text{BL PNF} \times \text{PROD} \times \text{BL Conc} \times \text{Unit Conversion Factor} \qquad (11\text{-}1)$$

where:

BL Load	=	Site or operation baseline pollutant loadings discharged to surface water or POTW by a site, lbs/yr;
BL PNF	=	Site or operation process wastewater baseline PNF, gal/ton;
PROD	=	Site or operation average production during 1997, assuming 365 days per year[4], tons/yr;
BL Conc	=	Site or operation baseline concentration, or average baseline concentration if no data provided for that pollutant, mg/L; and
Unit Conversion Factor	=	$8.345(10^{-6})$ lbs/gal/(mg/L).

For each site, EPA determined which manufacturing operations in each subcategory and segment generate wastewater and calculated pollutant loadings for each operation. For example, for integrated steelmaking, one site could have one basic oxygen furnace (BOF) and two continuous casting operations. For this example, EPA would determine the PNF and site-specific average baseline pollutant concentrations for the BOF. EPA would then perform a separate but similar determination and calculation for the casting operations. These baseline loadings would then be summed to calculate the baseline pollutant loadings for the subcategory for the site. Some subcategories do not have more than one operation; therefore, EPA did not have to sum the pollutant loadings and removals to calculate the baseline, treated, and removal loadings for each site.

For indirect dischargers, EPA also accounted for treatment at the POTW prior to discharge to surface waters using the following equation:

$$\text{BL Load}_{\text{POTW}} = (1 - \text{POTW \% Removal}) \times (\text{BL Load}) \qquad (11\text{-}2)$$

where:

$\text{BL Load}_{\text{POTW}}$	=	Site or operation baseline pollutant loadings discharged to surface water after treatment at the POTW, lbs/yr;
BL Load	=	Site or operation baseline pollutant loadings discharged to the POTW from Equation 11-1 for each indirect discharger, lbs/yr; and
POTW % Removal	=	Percent removal, shown in Table 11-3.

[4]EPA converted sites' annual reported productions to daily productions normalized to a 365 day production year to allow comparisons between facilities.

Most of the POTW percent removal values are based on data from the Fate of Priority Pollutants in Publicly Owned Treatment Works and National Risk Management Research Laboratory (NRMRL) Treatability Database and are discussed in Section 12 (References 11-1 and 11-2). The baseline and treated pollutant loadings and associated removals for indirect dischargers presented in this section represent discharge from POTWs to receiving streams using the above equation.

For each subcategory and segment, EPA multiplied the pollutant loadings for each site or operation by the survey weight and estimated the total industry baseline loadings for each subcategory and segment using the following equation:

$$\text{Weighted BL Load} = \sum (\text{BL Load} \times \text{SW}) \qquad (11\text{-}3)$$

where:

Weighted BL Load	=	Industry baseline pollutant loadings for a subcategory, lbs/yr;
BL Load	=	Site or operation baseline pollutant loadings from Equation 11-1 for direct dischargers and from Equation 11-2 for indirect dischargers, lbs/yr; and
SW	=	Survey weight, listed in Table A-4 of Appendix A of this document.

11.3 Methodology Used to Estimate Treated Pollutant Loadings

Treated pollutant loadings are estimates of pollutant loadings for each site that would result after implementation of the model technology options. EPA estimated treated pollutant loadings representing each option using model PNFs and long-term average effluent concentrations (LTAs). Section 13 describes the determination of the model PNFs and Section 14 describes the calculation of the model LTAs. For all subcategories (except the cokemaking subcategory), EPA did not calculate model LTAs for all POCs. To calculate the treated pollutant loadings, EPA calculated the arithmetic mean of BAT performance data for use as a surrogate for the model LTA when no model LTA was calculated for a POC.

11.3.1 Treated Pollutant Loadings Calculation

EPA estimated treated pollutant loadings for each site in the subcategory using the following equation:

$$\text{Treated Load} = \text{PNF} \times \text{PROD} \times \text{LTA} \times \text{Unit Conversion Factor} \qquad (11\text{-}4)$$

where:

Treated Load	=	Site or operation treated pollutant loadings as a result of implementing a particular technology option, lbs/yr;
PNF	=	Model PNF, gal/ton;
PROD	=	Site or operation average production during 1997, assuming 365 days per year[5], tons/yr;
LTA	=	Model LTA for each option, mg/L; and
Unit Conversion Factor	=	$8.345(10^{-6})$ lbs/gal/(mg/L).

If a site's or operation's baseline concentration for a particular pollutant was less than the model LTA for a particular option, then EPA did not estimate any removal associated with further concentration reduction for that pollutant (i.e., EPA set the LTA equal to the site's baseline concentration). If a site's or operation's PNF was lower than the model PNF, then EPA did not estimate any removal associated with further flow reduction (i.e., EPA set the PNF equal to the baseline PNF). Finally, in some cases, EPA used the site's baseline PNF or baseline pollutant concentrations to calculate the treated pollutant loadings, even though they exceed the model PNF or model LTAs, because the site did not exceed the model loading. These cases are dependent upon EPA's costing analysis as described in Section 11.5.

EPA adjusted the site's or operation's treated pollutant loading by the POTW percent removal for indirect dischargers, according to Equation 11-2. Using this equation, EPA calculated the treated pollutant loadings discharged to the surface water, after the wastewater is treated by the POTW.

After determining a site's or operation's treated pollutant loadings, EPA multiplied the site's or operation's treated pollutant loadings by the survey weight and estimated the treated pollutant loadings for each subcategory and segment using Equation 11-3.

11.4 Pollutant Removals Calculation

EPA estimated pollutant removals for each subcategory using the baseline pollutant loadings and treated pollutant loadings, as shown in the following equation:

$$\text{Removal Load} = \text{BL Load} - \text{Treated Load} \tag{11-5}$$

[5]EPA converted sites' annual reported productions to daily productions normalized to a 365 day production year to allow comparisons between facilities.

where:

Removal Load	=	Site or operation pollutant loadings removed for a site or operation as a result of implementing a particular technology option, for each pollutant, lbs/yr;
BL Load	=	Site or operation baseline pollutant loadings calculated by Equation 11-1, lbs/yr; and
Treated Load	=	Site or operation treated pollutant loadings as a result of implementing a particular technology option as calculated by Equation 11-4, lbs/yr.

Since the pollutant removals calculated using Equation 11-5 represent the removals for each site or operation before treatment at the POTW, EPA summed the removals for each site and adjusted the site's removal loading by the POTW percent removal for indirect dischargers, according to Equation 11-2. Using this equation, EPA calculated the amount of pollutants removed from the surface water by implementing each technology option.

After determining a site's removal loading, EPA multiplied the site removal loading by the survey weight and estimated the removal loading for each subcategory and segment, using Equation 11-3.

11.5 How the Costing Analysis Coordinates with the Method Used to Calculate Treated Pollutant Loadings and Pollutant Removals

Section 10 describes how EPA evaluated whether a site currently performs as well as or better than the model technology for an option, using the model LTAs and model PNF to calculate the model loading. To do this EPA calculated the baseline pollutant loading for each site for the regulated pollutants and compared it to the model loading to determine if the site currently meets the limitations. Then, EPA allocated costs to the site if the site did not meet the model loading for a regulated pollutant. Section 10 discusses the costing analysis in more detail. The costing analysis affects the loadings analysis because EPA based the calculation of treated loadings on the costing decisions presented in Section 10. If a site performed as well as or better than the model technology for pollutants considered for regulation, treated pollutant loadings remained unchanged from baseline pollutant loadings and the resultant pollutant removals were zero for that site. Similarly, costs were zero for that site. If the site did not perform as well as the model technology, EPA estimated treated loadings and pollutant removals for the site, based on the reduced PNF and/or upgrade to treatment in place. Specifically, to achieve treated effluent quality, EPA allocated costs to sites for the following scenarios: 1) install or improve wastewater treatment to reduce effluent pollutant concentrations, 2) reduce wastewater flow rates through recycling or in-process controls, or 3) improve wastewater treatment and reduce flow rates. These decisions directly affected how EPA estimated the treated pollutant loadings for each site and technology option. In scenario 1, EPA estimated costs for sites to improve wastewater treatment and set treated pollutant concentrations equal to the model LTAs. In scenario 2, EPA estimated costs for sites to reduce wastewater flow rates to achieve the model PNF and set the treated PNF equal to the model PNF. In scenario 3, both the treated pollutant concentrations and treated PNF were set equal to the model LTAs and PNF, respectively.

11.6 Example Calculation

The following example calculation shows the steps EPA used to calculate the baseline pollutant loadings, treated pollutant loadings, and pollutant removals.

11.6.1 Baseline Pollutant Loadings Calculation

Step 1. Identify available site-specific average baseline pollutant concentration data.

The first step is identifying the available data that are representative of the subcategory. For this example, EPA identified data for two hypothetical sites that comprise the integrated steelmaking subcategory. Site A is a direct discharger and Site B is an indirect discharger.

Available Site-Specific Average Baseline Pollutant Concentration Data

Site	Operation	Discharge Status	Baseline Zinc Concentration (mg/L)	Baseline Lead Concentration (mg/L)
Site A	Continuous Casting (CC)	Direct	0.13	Not available
Site A	Wet-Suppressed Basic Oxygen Furnace (BOF-WS)	Direct	Not available	0.15
Site B	Vacuum Degassing (VD)	Indirect	0.67	0.5
Site B	Continuous Casting (CC)	Indirect	0.12	0.01

Step 2. Calculate subcategory-specific average baseline pollutant concentrations to fill data gaps.

EPA calculated subcategory-specific average baseline pollutant concentrations for integrated steelmaking using available data as described in Section 11.2.2. The subcategory-specific average baseline pollutant concentrations were used to fill in data gaps for each site (i.e., used in place of “not available” in above table). The subcategory-specific average baseline pollutant concentrations were calculated below, using the data from the table in Step 1.

Subcategory-Specific Average Baseline Pollutant Concentration Data

Discharge	Average Zinc Concentration (mg/L)	Average Lead Concentration (mg/L)
Direct, Indirect (a)	0.31	0.22

(a) Average calculated using data from direct and indirect dischargers for all pollutants, except conventional parameters, which were calculated separately for direct and indirect dischargers.

Step 3. Calculate the baseline loadings for each operation and site.

EPA calculated the baseline pollutant loadings for each operation and POC using Equation 11-1 and the site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNF, and production for each operation presented in the table below.

Production, Baseline PNFs, Site-Specific Average Baseline Pollutant Concentrations, and Baseline Loadings for Each Site

Site	Operation	Production (tons/yr) (a)	Baseline PNF (gal/ton)	Baseline Zinc Concen-tration (mg/L)	Baseline Lead Concen-tration (mg/L)	Baseline Zinc Loading (lbs/yr)	Baseline Lead Loading (lbs/yr)
Site A	CC	2,190,000	1,800	0.13	0.22 (b)	4,276	7,237
Site A	BOF - WS	2,555,000	17	0.31 (b)	0.15	112	54.4
Site B	VD	1,095,000	64	0.67	0.5	392	292
Site B	CC	912,500	20	0.12	0.01	18.3	1.52

(a) Production in tons/yr = Production in tons/day multiplied by 365 days.
(b) Subcategory-specific average baseline pollutant concentration used.

Then, EPA summed the baseline loadings for each operation for each site.

Baseline Pollutant Loadings for Each Site

Site	Baseline Zinc Loading (lbs/yr)	Baseline Lead Loading (lbs/yr)
Site A	4,388	7,291
Site B (a)	410	294

(a) The baseline pollutant loadings presented for this site represent the pollutant loadings discharged to the POTW.

11.6.2 Treated Pollutant Loadings Calculation

Step 1. Review costing analysis for each site.

EPA used the following analysis for the hypothetical Sites A and B from Section 11.6.1 for both its pollutant removal and costing estimates:

- Site A: This site has two separate treatment systems that treat continuous casting (CC) and basic oxygen furnace - wet-suppressed (BOF-WS) wastewater. EPA identified and estimated costs for upgrades to both treatment systems that it believed were necessary to achieve the model pollutant loadings (i.e., model LTAs multiplied by the model PNF) for lead and zinc. For the CC treatment system, these upgrades included treatment to reduce the concentration of lead and zinc and flow reduction because the site exceeded both the model LTAs and model PNF. EPA estimated costs for these upgrades to achieve the model pollutant loading. See Section 10. For the BOF-WS treatment system, the upgrades included treatment to reduce the concentration of lead and zinc because the site exceeded the model LTAs, but flow reduction was not necessary because the baseline PNF was less than the model PNF; therefore, the site achieves the model pollutant loading when it reduces the lead and zinc concentrations to the model LTA. EPA estimated costs for these upgrades to achieve the model pollutant loading.

- Site B: This site has two separate treatment systems for the vacuum degassing (VD) and CC wastewater. EPA identified the upgrades to the VD treatment system that it believed were necessary to achieve the lead and zinc model loading. These upgrades included treatment to remove lead and zinc and flow reduction because the site exceeded both the model LTAs and model PNF. EPA estimated costs for these upgrades. See Section 10. EPA did not estimate any compliance costs for the CC system because the CC treated effluent achieves the model pollutant loadings.

Step 2. Calculate the treated pollutant loadings for each operation and site.

Using the analysis described above, model LTAs, and model PNF presented in the table below, EPA calculated the treated pollutant loadings for each operation using Equation 11-4.

Production, Model LTAs, Model PNFs, and Treated Pollutant Loadings for Each Operation

Site	Operation	Model Zinc LTA (mg/L)	Model Lead LTA (mg/L)	Model PNF (gal/ton)	Production (tons/yr) (a)	Treated Zinc Loading (lbs/yr)	Treated Lead Loading (lbs/yr)
Site A	CC	0.121	0.0141	25	2,190,000	55.3	6.44
Site A	BOF - WS	0.121	0.0141	17 (b)	2,555,000	43.9	5.11
Site B	VD	0.121	0.0141	13	1,095,000	14.4	1.67
Site B	CC	0.12 (b)	0.01 (b)	20 (b)	912,500	18.3	1.52

(a) Production in tons/yr = Production in tons/day multiplied by 365 days.
(b) These site-specific average baseline pollutant concentrations and PNFs were less than the model LTAs and model PNF; therefore, EPA used the sites' data to calculate the treated pollutant loadings.

EPA summed the treated pollutant loadings for each operation to calculate the treated pollutant loadings for each site.

Treated Pollutant Loadings for Each Site

Site	Treated Zinc Loading (lbs/yr)	Treated Lead Loading (lbs/yr)
Site A	99.2	11.6
Site B (a)	32.7	3.19

(a) The treated pollutant loadings presented for this site represent the pollutant loadings discharged to the POTW.

11.6.3 Pollutant Removals Calculation

Step 1. Subtract the treated pollutant loadings from the baseline pollutant loadings to calculate the pollutant removals.

Using Equation 11-5 and the baseline and treated pollutant loadings calculated in Sections 11.6.1 and 11.6.2, respectively, EPA calculated the pollutant removals for each operation for each hypothetical site.

Baseline and Treated Pollutant Loadings and Pollutant Removals for Each Operation

Site	Operation	Baseline Zinc Loadings (lbs/yr)	Treated Zinc Loadings (lbs/yr)	Zinc Removals (lbs/yr)	Baseline Lead Loadings (lbs/yr)	Treated Lead Loadings (lbs/yr)	Lead Removals (lbs/yr)
Site A	CC	4,276	55.3	4,221	7,237	6.44	7,231
Site A	BOF - WS	112	43.9	68.1	54.4	5.11	49.3
Site B (a)	VD	392	14.4	378	292	1.67	290
Site B (a)	CC	18.3	18.3	0	1.52	1.52	0

(a) The pollutant removals presented for this site represent the pollutant removals before treatment of the POTW.

Step 2. Calculate the pollutant removals for each site.

EPA summed the pollutant removals for each operation to calculate the pollutant removals for each site.

Pollutant Removals for Each Site

Site	Zinc Removal (lbs/yr)	Lead Removal (lbs/yr)
Site A	4,289	7,279
Site B (a)	378	290

(a) The pollutant removals presented for this site represent the pollutant removals before treatment at the POTW.

Step 3. Calculate the baseline pollutant loadings, treated pollutant loadings, and pollutant removals for the integrated steelmaking subcategory.

To calculate the pollutant loadings and removals for the integrated steelmaking subcategory, EPA multiplied the pollutant loadings and removals for each site by the survey weight using Equation 11-3. For indirect dischargers only, EPA applied Equation 11-2 to calculate the pollutant loadings and removals after treatment at the POTW for each site. Finally, EPA summed the pollutant loadings and removals for each site for the integrated steelmaking subcategory.

Weighted Baseline and Treated Pollutant Loadings and Removals for the Integrated Steelmaking Subcategory

Site	Survey Weight	Pollutant	POTW % Removal	Weighted (a) Baseline Loading (lbs/yr)	Weighted (a) Treated Loading (lbs/yr)	Weighted (a) Removal (lbs/yr)
Site A	1.03448	Zinc	NA	4,539	103	4,436
Site A	1.03448	Lead	NA	7,543	12.0	7,531
Site B	1	Zinc	79%	86.2	6.9	79.3
Site B	1	Lead	77%	67.6	0.734	66.8

NA - Not applicable because this site is a direct discharger.
(a) Weighted indicates that the survey weights have been applied. For indirect dischargers, the loadings presented represent what is discharged to surface water as calculated using Equation 11-2. The toxic weighting factor was not applied.

Therefore, for the integrated steelmaking subcategory, the amount of lead and zinc removed by the model technology for direct dischargers is 7,530 lbs/yr and 4,437 lbs/yr, respectively. For indirect dischargers, the amount of lead and zinc removed by the model technology is 66.7 lbs/yr and 79.4 lbs/yr, respectively. Note that to simplify this example, only two sites were included. Generally, there are many sites in a subcategory and the removals for sites with the same discharge status (e.g., direct and indirect) would be summed for each pollutant to calculate the pollutant reduction for the option.

After calculating the pollutant removals for each subcategory, EPA used these removals to evaluate the effectiveness, environmental benefits, and cost effectiveness of each regulatory option.

11.7 Pollutant Loadings and Removals for the Cokemaking Subcategory

EPA estimated pollutant loadings for 20 by-product recovery cokemaking sites: 12 direct dischargers and 8 indirect dischargers. One site shut down operations after 1997 and EPA was unable to verify costing assumptions and the site's reported high flow; therefore, this site was removed from the costing and loadings analyses. Non-recovery cokemaking sites are zero dischargers; therefore, EPA did not calculate pollutant loadings or removals for these sites.

EPA estimated pollutant loadings for 35 of the 72 POCs. Thirty of the POCs were not included in the loadings analysis because they were not detected in by-product recovery cokemaking effluent (listed in Table 11-1). Four of the remaining POCs were excluded because they failed the influent editing criteria (listed in Table 11-2). See Section 14 for more information regarding the influent editing criteria. Biochemical oxygen demand 5-day was excluded because it was a duplicate of another parameter (biochemical oxygen demand 5-day - carbonaceous). Amenable cyanide and fluoride were inadvertently left out of the loadings analysis. See the "Pollutant Loadings and Removals Inaccuracies" memorandum, document number IS10831 in Section 14.7 of rulemaking record for more information regarding these inaccuracies in the loadings model. In summary, no pollutant loadings or removals were calculated for a total of 37 POCs.

EPA calculated percent removals for the cokemaking subcategory using the influent and effluent data for the model BAT treatment facilities. For the BAT-1 option, nitrate/nitrite and total suspended solids (TSS) had negative percent removals for all the model facilities; therefore, no removals were calculated for these POCs. For the PSES-1 option, phenol and TSS had negative percent removals for all model facilities; therefore, no removals were calculated for these POCs. See Sections 12 and 14 for more information regarding the percent removals.

11.7.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each by-product recovery cokemaking facility using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs, and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each by-product recovery cokemaking site. EPA used applicable effluent concentration data from all 20 sites: 12 direct dischargers and 8 indirect dischargers. Fourteen sites provided industry self-monitoring data, nine sites provided survey summary data, and EPA collected data for three sites. EPA had data from multiple sources from five sites (e.g., two sites provided survey summary and industry self-monitoring data, two sites provided industry self-monitoring and EPA sampling data, and one site provided survey summary and EPA sampling data) that represented by-product recovery cokemaking wastewater. To calculate the site-specific average baseline pollutant concentrations for the two sites that submitted survey summary and industry self-monitoring data, EPA used the industry self-monitoring data. When no industry self-monitoring data were available for a POC, EPA used survey summary data for that POC. To calculate the site-specific average baseline pollutant concentrations for the remaining sites, EPA averaged the site's multiple data sets together. All 20 sites in the pollutant loadings analysis had baseline concentration data for ammonia as nitrogen. Seventeen of the sites also monitored for total cyanide and total recoverable phenolics. Several sites monitored for benzo(a)pyrene, benzene, and naphthalene, and TSS. For many pollutants, particularly many of the priority organic constituents, the only available data were from EPA sampling episodes.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for a site. To calculate subcategory-specific average baseline concentrations for by-product recovery cokemaking, EPA examined technology in place: 11 of the 12 direct dischargers had ammonia stills and biological treatment in place, and 1 site had an ammonia still followed by physical/chemical treatment (dephenolizer, sand filter, and clarifier). All of the eight indirect dischargers had ammonia stills, but three also had biological treatment. EPA calculated the subcategory-specific average baseline pollutant concentration for two types of sites: those with ammonia stills and biological treatment in place and those with ammonia stills only.

To calculate the subcategory-specific average baseline concentrations for sites with ammonia still treatment only, EPA used five data sets from the five indirect dischargers with ammonia stills only (no direct dischargers operate ammonia stills only). For 23 of the 35 POCs included in the analysis, no data were available from these sites; therefore, EPA used the ammonia still effluent sampling data from four by-product recovery cokemaking sites with ammonia stills and biological treatment to calculate subcategory-specific average baseline concentrations for these remaining POCs because these data are representative of sites without biological treatment (i.e., ammonia stills only). For POCs where data were available for both the five sites with only ammonia stills and the four sites with ammonia stills and biological treatment, all the data were averaged together. Table 11-4 presents the subcategory-specific average baseline pollutant concentrations for sites with ammonia stills only.

For sites with both ammonia stills and biological treatment, EPA calculated subcategory-specific average baseline concentrations by averaging 22 data sets for 16 sites, including industry self-monitoring data for some pollutants and biological treatment effluent sampling data from three by-product recovery cokemaking treatment systems for all pollutants. EPA included data from a site that shut down its operations after 1997 to calculate the average baseline concentrations because the data are representative of sites with both ammonia stills and biological treatment. EPA calculated a separate subcategory-specific average baseline pollutant concentration for TSS for direct and indirect dischargers. For the indirect dischargers, data were not available for BOD 5-day (carbonaceous) and O&G; therefore, EPA used the subcategory-specific average baseline pollutant concentrations for the direct dischargers for these conventional POCs. Table 11-4 presents the subcategory-specific average baseline pollutant concentrations for sites with both ammonia stills and biological treatment. EPA used the averages presented in this table to calculate the pollutant loadings for the BAT-1 and PSES-1 options only. See the “Pollutant Loadings and Removals for the Cokemaking Subcategory” memorandum, document number IS10836 in Section 14.7 of the rulemaking record, for the subcategory-specific average baseline pollutant concentrations used for the BAT-3 and PSES-3 options. See the “Pollutant Loadings and Removals Inaccuracies” memorandum, document number IS10831 in Section 14.7 of the rulemaking record, for more information regarding the subcategory-specific average baseline pollutant concentrations used for the BAT-3 and PSES-3 options.

The direct discharger with physical/chemical treatment in place provided survey summary data for ammonia as nitrogen, benzene, benzo(a)pyrene, naphthalene, total cyanide, total recoverable phenols, and TSS. Summary data were not available for the remaining POCs. In the 1982 iron and steel technical development document, EPA presented data for a site that had physical/chemical treatment similar to the treatment used by this direct discharger. Data from the 1982 technical development document were preferentially used to represent the site-specific average baseline concentrations for 11 of the remaining POCs. For the remaining POCs, EPA used the subcategory-specific average baseline concentrations from sites with ammonia stills and biological treatment in place because the concentrations of these pollutants were similar to or less than other pollutant concentrations discharged by the site with physical/chemical treatment. The site-specific average baseline pollutant concentrations used for this site are not disclosed to prevent compromising confidential business information.

Cotreatment

Two of the by-product recovery cokemaking sites discharge their wastewater to cotreatment systems. Although both of these sites provided cotreatment outfall data, EPA did not use these data because cokemaking wastewater comprised less than 90 percent of the influent to cotreatment. Both of these sites also provided cokemaking effluent data (i.e., data from an internal monitoring point following dedicated in-process cokemaking wastewater treatment before entering cotreatment). EPA used these data for both sites because EPA costed for upgrades to the dedicated cokemaking wastewater treatment systems at these sites to achieve the model effluent pollutant loadings.

Baseline Pollutant Loadings Calculation

Using the site-specific and subcategory-specific average baseline concentrations, baseline PNFs and production, EPA calculated baseline pollutant loadings for the by-product recovery cokemaking segment using Equations 11-1 and 11-3. For indirect dischargers, EPA further adjusted the pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-5 and 11-6 present the baseline pollutant loadings for direct and indirect dischargers, respectively, in the cokemaking subcategory.

11.7.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the by-product recovery cokemaking segment using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for the by-product recovery cokemaking segment. See the "Pollutant Loadings and Removals for the Cokemaking Subcategory" memorandum, DCN IS10836 in Section 14.7 of the rulemaking record, for more information regarding the LTAs. For indirect dischargers, EPA adjusted the treated pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-5 and 11-6 present the treated pollutant loadings for direct and indirect dischargers, respectively, in the cokemaking subcategory.

EPA calculated pollutant removals for the by-product recovery cokemaking segment as the difference between the treated and baseline pollutant loadings using Equation 11-5. The pollutant removals for BAT-1 were 346,000 lbs/yr for conventional pollutants, approximately 718,000 lbs/yr for nonconventional pollutants, and 30,200 lbs/yr for priority pollutants. The pollutant removals for BAT-3 were 1,070,000 lbs/yr for conventional pollutants, approximately 1,080,000 lbs/yr for nonconventional pollutants, and 56,900 lbs/yr for priority pollutants. For PSES-1, the pollutant removals were 260,000 lbs/yr for nonconventional pollutants and 4,390 lbs/yr for priority pollutants. For PSES-3, the pollutant removals were approximately 562,000 lbs/yr for nonconventional pollutants and 24,400 lbs/yr for priority pollutants. Tables 11-5 and 11-6 present the pollutant removals for direct and indirect dischargers, respectively, in the cokemaking subcategory.

The flow reduction for direct dischargers was 41.2 million gallons per year, a two-percent reduction. For indirect dischargers, the flow reduction was 50.2 million gallons per year, a nine-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the cokemaking subcategory, see the Pollutant Loadings and Removals for the Cokemaking Subcategory memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10836.

11.8 Pollutant Loadings and Removals for the Ironmaking Subcategory

EPA estimated pollutant loadings for the 15 ironmaking sites that generate and discharge process wastewater: 14 direct dischargers and 1 indirect discharger. Ten of the sites discharged only blast furnace wastewater, four sites discharged commingled blast furnace and sintering wastewater, and one site discharged only sintering wastewater.

For wastewater streams from blast furnace operations, EPA estimated pollutant loadings for 25 of the 27 POCs. For sites with commingled blast furnace and sintering wastewater, EPA combined the POCs for the blast furnace and sintering segments for a total of 67 POCs. EPA estimated pollutant loadings for 45 of these 67 POCs. For wastewater streams from only sintering operations, EPA estimated pollutant loadings for 43 of the 65 POCs. The remaining POCs (listed in Table 11-1) were excluded from the pollutant loadings analysis because they were never detected in ironmaking effluent.

11.8.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each ironmaking facility using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs, and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each operation in the ironmaking subcategory. EPA used applicable effluent concentration data from eleven direct dischargers and one indirect discharger to calculate the site-specific average baseline pollutant concentrations. Eight sites provided ISMD, two sites provided survey summary data, and EPA had sampling data for four sites (two of these sites also provided ISMD). For two sites, EPA had multiple data sets (e.g., ISMD and EPA sampling data) that represented one operation or where the wastewater from the blast furnace and sintering operations was combined for treatment. To calculate the site-specific average baseline pollutant concentrations for each site, EPA averaged the site's multiple data sets together. For two of the sites with sampling data, EPA had data for only dioxins and furans. Ten sites had site-specific average baseline concentration data for ammonia as nitrogen, lead, and zinc; nine sites had data for total cyanide; and eight sites had data for TSS. Three sites with blast furnace wastewater only did not provide monitoring data, and EPA had no sampling data for those sites.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. For the ironmaking subcategory, EPA calculated the subcategory-specific average baseline pollutant concentrations based on the type of wastewater discharged. Different subcategory-specific averages were calculated for sites with blast furnace wastewater only and sites with commingled blast furnace and sintering wastewater.

For sites that discharged blast furnace wastewater only, EPA used ten data sets from nine sites: seven direct dischargers, one indirect discharger, and one zero (i.e., alternative) discharger. To expand the size of the data set, EPA used sampling data from a site located in Canada and the alternative discharging site because the data are representative of blast furnace ironmaking wastewater. (EPA did not calculate pollutant loadings and removals for the Canadian site or the alternative discharger because the Canadian site is outside the scope of this U.S. regulation and the alternative discharger does not discharge wastewater.) Data were not available for the indirect discharger for the conventional pollutants O&G or TSS; therefore, for this site, EPA used the average of available data from direct dischargers for these POCs. Table 11-7 presents the subcategory-specific average baseline pollutant concentrations for sites that discharge blast furnace wastewater only.

For sites that discharged commingled blast furnace and sintering wastewater, EPA used the available data from two direct dischargers that commingled their blast furnace and sintering wastewater to calculate the subcategory-specific average baseline concentration for POCs other than dioxins and furans. These two sites provided a total of three applicable effluent data sets: sampling data and ISMD data from one site and ISMD data from the other site. For dioxins and furans, EPA calculated subcategory-specific average baseline concentrations using dioxin and furan sampling data from a site with commingled blast furnace and sintering wastewater and from a site with sintering wastewater only. Table 11-8 presents the subcategory-specific average baseline pollutant concentrations for sites with commingled blast furnace and sintering wastewater.

The site that discharged sintering wastewater only had sampling data available for all POCs; therefore, EPA did not calculate subcategory-specific average baseline pollutant concentrations for this site.

Cotreatment

Five of the ironmaking sites discharged their wastewater to cotreatment systems. Although four of these sites provided cotreatment effluent data, EPA did not use any of these data because ironmaking wastewater comprises less than 90 percent of the influent to cotreatment. Two of the four sites with cotreatment effluent data also provided ironmaking effluent data (i.e., data from an internal monitoring point following dedicated in-process ironmaking wastewater treatment before entering cotreatment). One site provided only ironmaking effluent data. Although the cotreatment systems at these sites provide additional wastewater treatment, the data from the internal monitoring points were used to calculate baseline loadings for all three sites because EPA costed for upgrades to the dedicated ironmaking wastewater treatment systems at these sites to achieve the model effluent pollutant loadings. EPA used the subcategory-specific average baseline pollutant concentrations for the other two sites.

Baseline Pollutant Loadings

For sites that commingled their blast furnace and sintering wastewater, EPA estimated pollutant loadings and removals for both the blast furnace wastewater and sintering wastewater. EPA used this method in order to accurately estimate the pollutant loadings discharged by the commingled stream (e.g., the treatment system effluent concentration represents both blast furnace and sintering wastewater). EPA multiplied the combined wastewater effluent pollutant concentrations by the blast furnace wastewater flow and production to determine the blast furnace effluent pollutant loadings, and then multiplied the same effluent pollutant concentrations by the sintering wastewater flow and production to determine the sintering pollutant loadings. For example, Site X has a blast furnace and a sintering operation. The site reported the flow rate and production for each operation separately, but provided the treatment system effluent pollutant concentrations for the combined wastewater stream. EPA calculated pollutant loadings and removals for the blast furnace and sintering operations at Site X separately, using the PNF and production for each operation and the effluent pollutant concentrations for the combined wastewater stream. Finally, EPA summed the pollutant loadings and removals for the two operations to calculate the total pollutant loadings for the site.

Using the site-specific and subcategory-specific average baseline pollutant concentrations, baseline PNFs, and production, EPA calculated baseline pollutant loadings for the ironmaking subcategory using Equations 11-1 and 11-3. For indirect dischargers, EPA further adjusted the baseline pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-11 and 11-12 present the baseline pollutant loadings for direct and indirect dischargers, respectively, in the ironmaking subcategory.

11.8.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the ironmaking subcategory using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. For the ironmaking subcategory, EPA calculated model LTAs for the regulated pollutants only. For the remaining POCs, EPA calculated the arithmetic mean of BAT performance data. See DCN IS10933 in Section 14.10 of the rulemaking record for more information. Tables 11-9 and 11-10 present the arithmetic means of BAT performance data for sites with blast furnace wastewater only and sites with commingled blast furnace and sintering wastewater, respectively. For indirect dischargers, EPA also adjusted the pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-11 and 11-12 present the treated pollutant loadings for direct and indirect dischargers, respectively, in the ironmaking subcategory.

EPA calculated pollutant removals for the ironmaking subcategory as the difference between the treated and baseline loadings using Equations 11-5. The pollutant removals for BAT-1 were 2,620,000 lbs/yr for conventional pollutants, 9,810,925 lbs/yr for nonconventional pollutants, and 100,570 lbs/yr for priority pollutants. The pollutant removals for PSES-1 were approximately 43,000 lbs/yr for nonconventional pollutants and 76.7 lbs/yr for priority pollutants. Tables 11-11 and 11-12 present the pollutant removals for direct and indirect dischargers, respectively, in the ironmaking subcategory.

The flow reduction for direct dischargers was 8.3 billion gallons per year, an 86-percent reduction. The indirect discharger had a flow reduction of 55 million gallons per year, a 70-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the ironmaking subcategory, see the <u>Pollutant Loadings and Removals for the Ironmaking Subcategory</u> memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10837.

11.9 <u>Pollutant Loadings and Removals for the Sintering Subcategory</u>

EPA estimated pollutant loadings for the five sintering sites that generate and discharge process wastewater: five direct dischargers and zero indirect dischargers. Four of the sites discharged commingled blast furnace and sintering wastewater, and one site discharged sintering wastewater only.

For commingled blast furnace and sintering wastewater streams, EPA combined the POCs for the blast furnace and sintering segments for a total of 67 POCs. EPA estimated pollutant loadings for 45 of these 67 POCs. For wastewater streams from only sintering operations, EPA estimated pollutant loadings for 43 of the 65 POCs. The remaining POCs (listed in Table 11-1), were excluded from the pollutant loadings analysis because they were never detected in sintering effluent.

11.9.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each sintering facility using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs, and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each operation in the sintering subcategory. EPA used seven effluent concentration data sets from five direct dischargers to calculate the site-specific average baseline pollutant concentrations. Three sites provided industry self-monitoring data and EPA collected sampling data for four sites (two of the four sites also provided ISMD). For two sites, EPA had multiple data sets (e.g., industry self-monitoring data and EPA sampling data) that represented one operation or where the wastewater from the blast furnace and sintering operations was combined for treatment. To calculate the site-specific average baseline pollutant concentrations for each site, EPA averaged the site's multiple data sets together. EPA had dioxin and furan data for four of the five sites. Sampling data were collected for all POCs at two sites and for only dioxins and furans at two sites.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. For the sintering subcategory, EPA calculated the subcategory-specific average baseline pollutant concentrations based on the type of wastewater discharged. EPA calculated subcategory-specific average baseline pollutant concentrations for sites that commingle their sintering and blast furnace wastewater (i.e., data from the site that discharged sintering wastewater only were not included in the average). The site that discharged sintering wastewater only had sampling data available for all POCs; therefore, EPA did not calculate subcategory-specific average baseline pollutant concentrations for this site.

To calculate the subcategory-specific average baseline pollutant concentrations for sites that commingled blast furnace and sintering wastewater, EPA used three data sets from two direct discharging sites for all POCs, except dioxins and furans. Sampling data were available for one site with commingled blast furnace and sintering wastewater. For dioxins and furans, EPA calculated subcategory-specific average baseline concentrations using data from two sites: one site with sintering wastewater only and one site with commingled sintering and blast furnace wastewater. Table 11-13 presents the subcategory-specific average baseline pollutant concentrations used for sites that commingled their sintering and blast furnace wastewater.

Cotreatment

Two sintering sites discharge their wastewater to cotreatment systems. One site provided cotreatment effluent data; however, EPA did not use these data because sintering wastewater represented less than 4% of the influent to cotreatment. The other site did not provide cotreatment effluent data. Sintering effluent sampling data (i.e., data from an internal monitoring point following dedicated in-process sintering wastewater treatment before entering cotreatment) were available for both sites. EPA used the data from the internal monitoring points to calculate the baseline pollutant loadings for both sites, even though the cotreatment systems provide additional treatment of the wastewater. These data were used because EPA costed for upgrades to the sites' dedicated sintering wastewater treatment systems to achieve the model effluent pollutant loadings.

Baseline Pollutant Loadings Calculation

For sites that commingled their blast furnace and sintering wastewater, EPA estimated pollutant loadings and removals for both the blast furnace wastewater and sintering wastewater. EPA used this method in order to accurately estimate the pollutant loadings discharged by the commingled wastewater stream (e.g., the treatment system effluent concentration represents both blast furnace and sintering wastewater). EPA multiplied the combined wastewater effluent pollutant concentrations by the blast furnace wastewater flow and production to determine the blast furnace effluent pollutant loadings and then multiplied the same effluent pollutant concentrations by the sintering wastewater flow and production to determine the sintering pollutant loadings. For example, Site X has a blast furnace and a sintering operation. The site reported the flow rate and production for each operation separately, but provided the treatment system effluent pollutant concentrations for the combined wastewater stream. EPA calculated pollutant loadings and removals for the blast furnace and sintering operations at Site X separately, using the PNF and production for each operation and the effluent pollutant concentrations for the combined wastewater stream. Finally, EPA summed the pollutant loadings and removals for the two operations to calculate the total pollutant loadings for the site.

Using the site-specific and subcategory-specific average baseline pollutant concentrations, baseline PNFs, and production, EPA calculated baseline pollutant loadings for the sintering subcategory using Equations 11-1 and 11-3. Table 11-15 presents the baseline pollutant loadings for direct dischargers in the sintering subcategory.

11.9.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the sintering subcategory using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. EPA calculated removals for only dioxins and furans using the analytical minimum levels as the treated effluent concentration (listed in Table 11-14) for dioxins and furans for the sintering subcategory. Table 11-15 presents the treated pollutant loadings for direct dischargers in the sintering subcategory.

EPA calculated pollutant removals for the sintering subcategory as the difference between the treated and baseline pollutant loadings using Equation 11-5. For the sintering subcategory, EPA calculated removals only for dioxins and furans because those were the only parameters treated by the technology option under consideration. Therefore, the pollutant removals for BAT-1 were 0 lbs/yr for conventional pollutants and 0.00138 lbs/yr for priority and nonconventional pollutants. Table 11-15 presents the pollutant removals for direct dischargers in the sintering subcategory.

For more information regarding the calculation of pollutant loadings and removals for the sintering subcategory, see the Pollutant Loadings and Removals for the Sintering Subcategory memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10844.

11.10 Pollutant Loadings and Removals for the Integrated Steelmaking Subcategory

EPA estimated pollutant loadings for the 19 direct dischargers with integrated steelmaking operations. There were no indirect dischargers in the integrated steelmaking subcategory. In addition, one integrated steelmaking site shut down operations permanently after 1997, and EPA was unable to verify costing assumptions and the site's reported high flow; therefore, this site was not included in the costing and loadings analyses.

The integrated steelmaking subcategory includes the following operations: basic oxygen furnace (BOF) steelmaking, vacuum degassing, and continuous casting. Sites with BOF processes may operate semi-wet, wet-open, or wet-suppressed air pollution control systems. Under the 1982 regulation, BOF operations with semi-wet air pollution control systems are required to achieve zero discharge; therefore EPA did not calculate pollutant loadings or removals for these operations. Section 5 describes in more detail the different types of BOF air pollution control systems. Of the 19 integrated steel sites, 8 generate wastewater from all three operations, 4 from BOF steelmaking and continuous casting, 3 from vacuum degassing and continuous casting, 1 from BOF steelmaking only, and 3 from continuous casting only. EPA calculated pollutant loadings and removals for BOF, vacuum degassing, and continuous casting wastewater streams separately for each site.

EPA estimated pollutant loadings for 19 of the 28 POCs for the integrated steelmaking subcategory. Two POCs were not included in the loadings analysis because they were not detected in integrated steelmaking effluent (listed in Table 11-1). Seven of the remaining nine POCs were excluded because they failed the influent editing criteria (listed in Table 11-2). See Section 14 for more information regarding the influent editing criteria and DCN IS10899 in Section 14.7 of the rulemaking record for the results of this analysis that were used for the pollutant loadings analysis.

EPA calculated percent removals for the integrated steelmaking subcategory using the influent and effluent data for the model facilities. For the BAT-1 option, nitrate/nitrite had negative percent removals for all the model facilities; therefore, EPA did not calculate pollutant removals for this POC. See Sections 12 and 14 for more information regarding the percent removals.

11.10.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each integrated steelmaking facility using available site-specific and subcategory-specific average baseline pollutant concentrations, baseline PNFs and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each operation in the integrated steelmaking subcategory. EPA used applicable effluent concentration data from 11 direct dischargers to calculate the site-specific average baseline pollutant concentrations. Nine sites provided ISMD, two sites provided survey summary data, and EPA collected sampling data for three sites. Eight of the nineteen sites did not provide any data and EPA did not have sampling data for these sites. For three sites, EPA had multiple data sets (e.g., industry self-monitoring data and EPA sampling data) that represented one operation or where the wastewater for several operations was combined for treatment. To calculate the site-specific average baseline pollutant concentrations for each site, EPA averaged the site's multiple data sets together. All 11 sites that provided applicable effluent data had site-specific average baseline concentration data for lead and zinc; 10 sites additionally provided applicable data for TSS. For 13 of the POCs, EPA only had sampling data for three sites.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as surrogates for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. For the integrated steelmaking subcategory, EPA calculated the subcategory-specific average baseline pollutant concentrations using sampling data from 3 sites and industry self-monitoring data from 10 sites. EPA sampled BOF and continuous casting wastewater from two sites, and BOF, vacuum degassing, and continuous casting wastewater from one site. Table 11-16 presents the subcategory-specific average baseline pollutant concentrations for the integrated steelmaking subcategory.

Cotreatment

Twelve of the integrated steelmaking sites discharge their wastewater to cotreatment systems. Although 11 of these sites provided cotreatment effluent data, EPA did not use these data because steelmaking wastewater comprised less than 90 percent of the total flow through the cotreatment system; therefore, EPA considers the data to be not representative of steelmaking wastewater. In addition, at six of these sites, dilution water comprised more than 10 percent of the influent to cotreatment.

For seven of these sites, EPA had no other data; therefore, EPA used the subcategory-specific average baseline pollutant concentrations. Four of these sites also provided integrated steelmaking internal monitoring data (i.e., data from an internal monitoring point following dedicated in-process steelmaking wastewater treatment before entering cotreatment). Although the cotreatment systems at these sites provide additional wastewater treatment, the data from the internal monitoring points were used to calculate baseline loadings for all four sites because EPA costed for upgrades to the dedicated integrated steelmaking wastewater treatment systems at these sites to achieve the model effluent pollutant loadings. For one site, EPA had no data available; therefore, the Agency used the subcategory-specific average baseline pollutant concentrations to calculate the baseline loadings.

Baseline Pollutant Loadings Calculation

Using the site-specific and subcategory-specific average baseline pollutant concentrations, baseline PNFs, and production, EPA calculated baseline pollutant loadings for the integrated steelmaking subcategory using Equations 11-1 and 11-3. Table 11-18 presents the baseline pollutant loadings for direct dischargers in the integrated steelmaking subcategory.

11.10.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for integrated steelmaking sites using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. EPA calculated the arithmetic mean of BAT performance data for each POC for this subcategory (presented in Table 11-17). See DCN IS10587 in Section 14.10 of the rulemaking record for more information. Table 11-18 presents the treated pollutant loadings for direct dischargers in the integrated steelmaking subcategory.

EPA calculated pollutant removals for the integrated steelmaking subcategory as the difference between the treated and baseline pollutant loadings using Equation 11-5. The pollutant removals for BAT-1 were 892,000 lbs/yr for conventional pollutants, 4,310,000 lbs/yr for nonconventional pollutants, and 42,700 lbs/yr for priority pollutants. Table 11-18 presents the pollutant removals for direct dischargers in the integrated steelmaking subcategory.

The overall flow reduction for direct dischargers was 6.2 billion gallons per year, a 65-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the integrated steelmaking subcategory, see the Pollutant Loadings and Removals for the Integrated Steelmaking Subcategory memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10838.

11.11 Pollutant Loadings and Removals for the Integrated and Stand-Alone Hot Forming Subcategory

EPA estimated the pollutant loadings and removals for 36 discharging integrated and stand-alone hot forming sites: 34 carbon and alloy steel and 2 stainless steel. Of the 34 carbon and alloy steel sites, 31 discharged directly and 3 discharged indirectly. Of the two stainless steel sites, both discharged indirectly. These sites represent a total industry population of approximately 52 sites (49 carbon and alloy steel and 3 stainless steel sites). One integrated and stand-alone hot forming site shut down all operations permanently after 1997, and EPA was unable to verify costing assumptions and the site's reported high flow; therefore, EPA removed this site from the costing and loadings analyses. EPA estimated pollutant loadings for all 11 POCs for the carbon and alloy steel segment and all 15 POCs for the stainless steel segment.

11.11.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for integrated and stand-alone hot forming sites using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each operation in the integrated and stand-alone hot forming subcategory. EPA used applicable effluent concentration data from 16 sites in the carbon and alloy segment: 1 indirect discharger and 15 direct dischargers. Eleven of the sites provided ISMD, five of the sites provided survey summary data, and EPA collected sampling data for three sites (all three sites also supplied industry self-monitoring data). Neither of the two stainless steel sites provided effluent data for the integrated and stand-alone hot forming subcategory. Three sites provided multiple data sets (e.g., two sites submitted industry self-monitoring and EPA sampling data and one site provided industry self-monitoring and permit application data) that represented the same operation or where the wastewater for several operations was combined for treatment. To calculate the site-specific average baseline pollutant concentrations for each site, EPA averaged the site's multiple data sets together. Of the 16 sites, 15 sites had site-specific average baseline concentration data for TSS, 10 sites additionally had data for iron, 7 sites additionally had data for zinc, and 6 sites additionally had data for lead.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. To calculate the subcategory-specific average baseline pollutant concentrations for the integrated and stand-alone hot forming subcategory, EPA averaged available site-specific average baseline pollutant concentration data for the carbon and alloy and stainless steel segments separately.

For the carbon and alloy steel segment, 16 direct dischargers and 1 indirect dischargers provided a total of 23 applicable effluent data sets used to calculate the subcategory-specific average baseline pollutant concentrations. EPA used sampling effluent data from one of the Canadian sites because the data were representative of the integrated and stand-alone hot forming subcategory. (Pollutant loadings and removals were not calculated for the Canadian site because it was outside of the scope for this U. S. regulation.) For the subcategory-specific average baseline pollutant concentrations for indirect dischargers, data were not available for one conventional pollutant, O&G. For this pollutant, EPA used the subcategory-specific average baseline concentration for the direct dischargers as the average for indirect dischargers. Table 11-19 presents the subcategory-specific average baseline pollutant concentrations for the integrated and stand-alone hot forming subcategory, carbon and alloy steel segment.

For the stainless steel segment, no sites provided applicable effluent data; therefore, EPA transferred hot forming effluent data from the non-integrated steelmaking and hot forming subcategory, stainless steel segment to calculate the subcategory-specific average baseline pollutant concentrations. It was reasonable to transfer these data because water use and wastewater characteristics of stainless steel hot forming operations at non-integrated steel mills are similar to those at integrated and stand-alone hot forming mills. EPA did not transfer continuous casting effluent data from the non-integrated steelmaking and hot forming subcategory, stainless steel segment because the integrated and stand-alone hot forming subcategory applies only to hot forming operations. Instead, EPA used the effluent data from only the hot forming operations. EPA used four hot forming effluent data sets from three sites: sampling data for a direct discharger and an indirect discharger and ISMD for an indirect discharger. Table 11-20 presents the subcategory-specific average baseline pollutant concentrations for the integrated and stand-alone hot forming subcategory, stainless steel segment.

Cotreatment

Ten sites discharge their integrated and stand-alone hot forming wastewater to cotreatment systems and all of these sites provided cotreatment effluent data. For two of these sites, EPA used cotreatment effluent data to calculate baseline pollutant loadings. EPA did not use cotreatment effluent data for the remaining eight sites because either dilution water comprised greater than 10 percent of the influent to cotreatment or hot forming wastewater comprised less than 90 percent of the influent to cotreatment. One of the sites whose cotreatment effluent data were not used also provided hot forming effluent data (i.e., data from an internal monitoring point following dedicated in-process hot forming wastewater treatment before entering cotreatment). Although the cotreatment system provides additional treatment of this wastewater, the data from the internal monitoring point were used to calculate baseline pollutant loadings because EPA costed for upgrades to the site’s dedicated hot forming wastewater treatment system to achieve the model effluent pollutant loadings. The remaining seven sites did not provide any other data; therefore, EPA used the subcategory-specific average baseline pollutant concentrations to calculate the baseline pollutant loadings.

Baseline Pollutant Loadings Calculation

Using the site-specific and subcategory-specific average baseline pollutant concentrations, baseline PNFs, and production, EPA calculated baseline pollutant loadings for the integrated and stand-alone hot forming subcategory using Equations 11-1 and 11-3. For indirect dischargers, EPA also further adjusted the pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-23 and 11-24 present baseline pollutant loadings for direct and indirect dischargers in the carbon and alloy segment, respectively. Table 11-25 presents baseline pollutant loadings for indirect dischargers in the stainless steel segment.

11.11.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the integrated and stand-alone hot forming subcategory using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. For the carbon and alloy steel segment, EPA calculated model LTAs for the regulated pollutants only. For the remaining POCs, EPA calculated the arithmetic mean of BAT performance data (presented in Table 11-21). See DCN IS10933 in Section 14.10 of the rulemaking record for more information. For the stainless steel segment, no performance data were available; therefore, EPA transferred the LTAs from the non-integrated steelmaking and hot forming, stainless steel segment, which are presented in Table 11-22. It was reasonable to transfer these data because water use and wastewater characteristics of stainless steel hot forming operations at non-integrated steel mills are similar to those at integrated and stand-alone hot forming mills. For indirect dischargers, EPA adjusted the treated pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-23 and 11-24 present treated pollutant loadings for direct and indirect dischargers in the carbon and alloy segment, respectively. Table 11-25 presents the treated pollutant loadings for indirect dischargers in the stainless steel segment.

EPA calculated pollutant removals for the integrated and stand-alone hot forming subcategory as the difference between the treated and baseline pollutant loadings, using Equation 11-5. For the carbon and alloy steel segment, the pollutant removals for BAT-1 were 35,300,000 lbs/yr for conventional pollutants, 12,290,000 lbs/yr for nonconventional pollutants, and 92,200 lbs/yr for priority pollutants. For PSES-1, the pollutant removals for the carbon and alloy steel segment were 5,610 lbs/yr for nonconventional pollutants and 9.14 lbs/yr for priority pollutants. Tables 11-23 and 11-24 present pollutant removals for direct and indirect dischargers in the carbon and alloy segment, respectively.

For the stainless steel segment, the pollutant removals for BAT-1 were 0 lbs/yr for nonconventional and priority pollutants because there were no direct dischargers. For the stainless steel segment, the pollutant removals for PSES-1 were approximately 1,270 lbs/yr for nonconventional pollutants and 164 lbs/yr for priority pollutants. Table 11-25 presents pollutant removals for indirect dischargers in the stainless steel segment.

The flow reduction for the carbon and alloy steel segment direct dischargers was 120 billion gallons per year, a 95-percent reduction. The flow reduction for the carbon and alloy steel segment indirect dischargers was 57.1 million gallons per year, a 50-percent reduction. The flow reduction for the stainless steel segment indirect dischargers was 15.7 million gallons for the year, a 90-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the integrated and stand-alone hot forming subcategory, see the Pollutant Loadings and Removals for the Integrated and Stand-Alone Hot Forming Subcategory memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10839.

11.12 Pollutant Loadings and Removals for the Non-Integrated Steelmaking and Hot Forming Subcategory

EPA calculated pollutant loadings for the 48 discharging non-integrated steelmaking and hot forming sites: 42 carbon and alloy steel and 6 stainless steel sites. Of the 42 carbon and alloy steel sites, 31 discharged directly, 10 discharged indirectly, and 1 discharged directly and indirectly. Of the six stainless steel sites, three discharged directly, two discharged indirectly, and one discharged directly and indirectly. These sites represent a total industry population of approximately 65 sites.

The non-integrated steelmaking and hot forming subcategory includes the following operations: vacuum degassing, continuous casting, and hot forming. Of the 48 non-integrated steelmaking and hot forming sites, 10 generated wastewater from all three operations, 28 from continuous casting and hot forming, 3 from vacuum degassing and hot forming, 4 from hot forming only, 2 from continuous casting only, and 1 from vacuum degassing only.

EPA estimated pollutant loadings for all 15 POCs for the carbon and alloy steel segment and for 21 of the 22 POCs for the stainless steel segment. One POC for the stainless steel segment, tribromomethane, was never detected in the effluent at any stainless steel sites and, therefore, was not included in the loadings analysis.

11.12.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each non-integrated steelmaking and hot forming facility using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs, and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each operation in the non-integrated steelmaking and hot forming subcategory. EPA used applicable effluent concentration data for 18 carbon and alloy steel sites and 3 stainless steel sites to calculate the site-specific average baseline pollutant concentrations. Twelve sites provided industry self-monitoring data, 10 sites provided survey summary data, 1 site provided permit application data, and EPA collected sampling data for 3 sites. For three sites, EPA had multiple data sets (i.e., one site had self-monitoring and EPA sampling data, one site had survey summary and EPA sampling data and the remaining site had self-monitoring and permit application data) that represented one operation. To calculate the site-specific average baseline pollutant concentrations for the site that provided self-monitoring and permit application data, EPA used the industry self-monitoring data only. To calculate the site-specific average baseline pollutant concentrations for the remaining two sites, EPA averaged the sites' multiple data sets together. One non-integrated site provided data for a pressure casting operation. EPA did not use these data to calculate the site-specific average baseline pollutant concentrations because pressure casting operations are not covered by this regulation. Twenty-six of the surveyed sites did not provide effluent concentration data, and EPA had no sampling data for these sites. Most of the sites that provided data monitored for lead, total suspended solids, and zinc. Several also monitored for copper and O&G.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. For the non-integrated steelmaking and hot forming subcategory, EPA calculated separate subcategory-specific average baseline pollutant concentrations for the carbon and alloy and stainless steel segments.

For the carbon and alloy steel segment, 12 direct dischargers, 7 indirect dischargers, and 1 site that discharges both directly and indirectly provided a total of 25 applicable effluent data sets used to calculate the subcategory-specific average baseline pollutant concentrations. One of the direct dischargers did not begin operation until after 1997. However, to expand the size of the data set, EPA included this site's data in the calculation of the subcategory-specific average baseline pollutant concentrations because the data are representative of carbon and alloy steel sites. EPA also used data from a pressure casting operation at one site to calculate the subcategory-specific average baseline pollutant concentrations for the carbon and alloy steel segment of the non-integrated subcategory because the data represent non-integrated steelmaking and hot forming wastewater characteristics. Table 11-26 presents the subcategory-specific average baseline pollutant concentrations used for the 15 POCs for both direct and indirect dischargers.

For the stainless steel segment, one direct discharger and two indirect dischargers provided a total of seven applicable effluent data sets used to calculate the subcategory-specific average baseline pollutant concentrations. Table 11-27 presents the subcategory-specific average baseline pollutant concentrations used for the 21 POCs for both direct and indirect dischargers.

Cotreatment

Two non-integrated steelmaking and hot forming sites discharged their wastewater to cotreatment systems. These sites did not provide cotreatment effluent data or non-integrated steelmaking and hot forming effluent data (i.e., data from an internal monitoring point following dedicated in-process non-integrated steelmaking and hot forming wastewater treatment before entering cotreatment). EPA used the subcategory-specific average baseline pollutant concentrations to calculate pollutant loadings for these sites.

Baseline Pollutant Loadings Calculation

Using the site-specific and subcategory-specific average baseline pollutant concentrations, baseline PNFs, and production, EPA calculated baseline pollutant loadings for the non-integrated steelmaking and hot forming subcategory using Equations 11-1 and 11-3. For indirect dischargers, EPA further adjusted the pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-30 and 11-32 present the baseline pollutant loadings for direct and indirect dischargers, respectively, in the carbon and alloy steel segment. Tables 11-31 and 11-33 present the baseline pollutant loadings for direct and indirect dischargers, respectively, in the stainless steel segment.

For some sites, industry survey information were insufficient to calculate a site's baseline PNF; therefore, EPA used the model PNF to estimate baseline pollutant loadings for that site.

11.12.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the non-integrated steelmaking and hot forming subcategory using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. Table 11-28 presents the LTAs for the carbon and alloy steel segment. See DCN IS10927 of Section 14.10 of the rulemaking record for more information. For the stainless steel segment, EPA calculated model LTAs for the regulated POCs only. For the remaining POCs, EPA calculated the arithmetic mean of BAT performance data (presented in Table 11-29). See DCN IS10933 in Section 14.10 of the rulemaking record for more information. For indirect dischargers, EPA further adjusted the pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-30 and 11-32 present the treated pollutant loadings for direct and indirect dischargers, respectively, in the carbon and alloy steel segment. Tables 11-31 and 11-33 present the treated pollutant loadings for direct and indirect dischargers, respectively, in the stainless steel segment.

EPA calculated pollutant removals for the non-integrated steelmaking and hot forming subcategory as the difference between the baseline and treated pollutant loadings using

Equation 11-5. For the carbon and alloy steel segment, the pollutant removals for BAT-1 were 2,850,000 lbs/yr for conventional pollutants, approximately 447,000 lbs/yr for nonconventional pollutants, and 12,600 lbs/yr for priority pollutants. For PSES-1, the pollutant removals were approximately 1,380 lbs/yr for nonconventional pollutants and 67.6 lbs/yr for priority pollutants. Tables 11-30 and 11-32 present the pollutant removals for direct and indirect dischargers, respectively, in the carbon and alloy segment.

For the stainless steel segment, the pollutant removals for BAT-1 were 17,100 lbs/yr for conventional pollutants, 52,400 lbs/yr for nonconventional pollutants, and 2,440 lbs/yr for priority pollutants. For PSES-1, the pollutant removals were approximately 27,400 lbs/yr for nonconventional pollutants and 722 lbs/yr for priority pollutants. Tables 11-31 and 11-33 present the pollutant removals for direct and indirect dischargers, respectively, in the stainless steel segment.

For carbon and alloy steel sites, EPA estimated the flow reductions for direct dischargers to be 14.8 billion gallons per year, an 89-percent reduction. For carbon and alloy indirect dischargers, EPA estimated the flow reduction to be 137 million gallons per year, a 23-percent reduction. For stainless steel sites, EPA estimated the flow reductions for direct dischargers to be 101 million gallons per year, a 48-percent reduction. For stainless steel indirect dischargers, EPA estimated the flow reduction to be 104 million gallons per year, an 89-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the non-integrated steelmaking and hot forming subcategory, see the Pollutant Loadings and Removals for the Non-Integrated Steelmaking and Hot Forming memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10840.

11.13 Pollutant Loadings and Removals for the Steel Finishing Subcategory

EPA estimated the pollutant loadings and removals for 84 discharging steel finishing sites: 63 carbon and alloy steel and 21 stainless steel sites. Of the 63 carbon and alloy steel sites, 41 discharged directly, 21 discharged indirectly, and 1 discharged both directly and indirectly. Of the 21 stainless steel sites, 11 discharged directly, 7 discharged indirectly, and 3 discharged both directly and indirectly. These sites represent a total industry population of approximately 110 sites. One steel finishing site shut down all operations permanently after 1997 and EPA was unable to verify costing assumptions and the site's reported high flow; therefore, EPA removed this site from the costing and loadings analyses.

For the pollutant loadings analysis, the steel finishing subcategory includes the following operations: acid pickling, cold forming, alkaline cleaning, continuous annealing, hot coating, and electroplating. Of the 84 steel finishing sites included in the loadings analysis, 45 sites had cold forming operations, 57 sites had acid pickling operations, 21 sites had alkaline cleaning operations, 26 sites had hot coating operations, 23 had electroplating operations, 7 sites had annealing operations, and 3 sites had descaling operations. Most of the sites in the steel finishing subcategory had multiple operations.

EPA estimated pollutant loadings and removals for 29 of the 37 POCs in the carbon and alloy steel segment and 32 of the 49 POCs in the stainless steel segment. The remaining POCs (listed in Table 11-1) were not included in the loadings analysis because these POCs were never detected in steel finishing effluent.

11.13.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each steel finishing facility using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs, and manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for the each operation in the steel finishing subcategory. For the carbon and alloy steel segment, EPA used applicable effluent data for 26 sites: 19 direct dischargers and 7 indirect dischargers. Ten sites provided survey summary data, 16 sites provided ISMD, and EPA collected sampling data for 4 sites (all 4 sites also provided ISMD). For the stainless steel segment, EPA used applicable effluent data for 13 sites: 9 direct dischargers and 4 indirect dischargers. Six sites provided survey summary data, five sites provided ISMD, and two sites provided sampling data. For five carbon and alloy steel sites, EPA had multiple data sets (e.g., one site had two industry self-monitoring data sets and fours sites had sampling data and industry self-monitoring data) that represented one operation or where the wastewater for several operations was combined for treatment. To calculate the site-specific average baseline pollutant concentrations for each site, EPA averaged the site's multiple data sets together.

Of the 26 carbon and alloy steel sites, 25 sites had data for zinc, 23 sites had data for TSS, and 22 sites had data for lead. All 13 stainless steel sites had data for chromium and nickel. Of the 13 stainless steel sites, 10 sites had data for TSS, 9 sites had data for copper, and 8 sites had data for lead and zinc.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. To calculate the subcategory-specific average baseline concentrations for the steel finishing subcategory, EPA averaged available site-specific average baseline concentration data for the carbon and alloy and stainless steel segments separately.

For the carbon and alloy steel segment, 18 direct dischargers and 8 indirect dischargers provided a total of 35 applicable effluent data sets used to calculate the subcategory-specific average baseline concentrations. In addition, to expand the size of the data set, EPA used effluent data from a Canadian mill to calculate subcategory-specific average baseline concentrations for the carbon and alloy segment because EPA considers data from this site to represent carbon and alloy steel finishing wastewater characteristics. (EPA did not calculate pollutant loadings and removals for this site because it is outside the scope of this U.S. regulation.) Table 11-34 presents the subcategory-specific average baseline pollutant concentrations for the steel finishing subcategory, carbon and alloy steel segment.

For the stainless steel segment, nine direct dischargers and four indirect dischargers provided a total of 14 applicable effluent data sets used to calculate the subcategory-specific average baseline concentrations. For the subcategory-specific average baseline concentrations for indirect dischargers, data were not available for one conventional pollutant, O&G. For this pollutant, EPA used the subcategory-specific average baseline concentration for the direct dischargers as the average for indirect dischargers. Table 11-35 presents the subcategory-specific average baseline pollutant concentrations for the steel finishing subcategory, stainless steel segment.

One site in the steel finishing subcategory is a carbon and alloy steel site with a stainless steel operation. To simplify the pollutant loadings and removal analyses for this site, EPA used the carbon and alloy steel segment POCs for both the carbon and alloy steel and stainless steel operations. Since this site did not provide effluent data for the stainless steel operation, EPA used subcategory-specific average baseline concentrations for the stainless steel segment to fill data gaps for this site. However, because some POCs in the carbon and alloy steel segment are not stainless steel POCs, EPA used the subcategory-specific average baseline concentrations for the carbon and alloy steel segment to fill the remaining data gaps.

Cotreatment

Eleven of the steel finishing sites discharged their wastewater to cotreatment systems. Ten of these sites provided cotreatment effluent data. EPA used the cotreatment effluent data to calculate baseline pollutant loadings for one site because steel finishing wastewater comprises 99.5 percent of the influent to cotreatment for this site. EPA did not use the cotreatment effluent data for nine sites because either dilution water comprised greater than 10 percent of the influent to cotreatment or steel finishing wastewater comprised less than 90 percent of the influent to cotreatment; therefore, EPA considers the data to be not representative of steel finishing wastewater.

For eight of the nine remaining sites with cotreatment data, EPA had no other data; therefore, EPA used the subcategory-specific average baseline pollutant concentrations. One of the nine sites with cotreatment data also provided steel finishing effluent data (i.e., data from an internal monitoring point following dedicated in-process steel finishing wastewater treatment before entering cotreatment). For this site, EPA used the steel finishing data because these data were used to determine that this site achieves model loadings and no treatment system upgrades are necessary. For the one site that did not provide cotreatment effluent data, EPA had no other data; therefore, EPA used the subcategory-specific average baseline pollutant concentrations to calculate baseline pollutant loadings.

Baseline Pollutant Loadings Calculation

For some sites in the steel finishing subcategory, industry survey information was insufficient to calculate an operation's baseline PNF; therefore, EPA calculated a surrogate PNF to calculate the baseline pollutant loadings. EPA calculated surrogate PNFs by transferring PNFs from other sites with similar operations and production within a segment/subcategory.

Using the site-specific and subcategory-specific average baseline concentrations, baseline PNFs, and production, EPA calculated baseline pollutant loadings for the steel finishing subcategory using Equations 11-1 and 11-3. For indirect dischargers, EPA further adjusted the baseline pollutant loadings using Equation 11-2 to account for additional removals at the POTW. Tables 11-38 and 11-40 present the baseline pollutant loadings for direct and indirect dischargers, respectively, in the carbon and alloy steel segment. Tables 11-39 and 11-41 present the baseline pollutant loadings for direct and indirect dischargers, respectively, in the stainless steel segment.

11.13.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the steel finishing subcategory using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. Table 11-36 presents the arithmetic mean of BAT performance data for each POC for the carbon and alloy steel segment. See DCN IS10813 in Section 14.10 of the rulemaking record for more information. For the stainless steel segment, EPA calculated LTAs for the regulated pollutants only. For the remaining POCs, EPA calculated the arithmetic mean of BAT performance data (presented in Table 11-37). See DCN IS10933 in Section 14.10 of the rulemaking record for more information. For indirect dischargers, EPA further adjusted the treated pollutant loadings using Equation 11-2 to account for additional removals at the POTW. For the site that is a carbon and alloy steel finishing site with a stainless steel finishing operation, EPA used stainless steel segment LTAs for the stainless steel POCs and used the carbon and alloy steel segment LTAs for the remaining POCs to calculate the treated pollutant loadings. Tables 11-38 and 11-40 present the treated pollutant loadings for direct and indirect dischargers, respectively, in the carbon and alloy steel segment. Tables 11-39 and 11-41 present the treated pollutant loadings for direct and indirect dischargers, respectively, in the stainless steel segment.

EPA calculated pollutant removals for the steel finishing subcategory as the difference between the treated and baseline pollutant loadings, using Equation 11-5. For the carbon and alloy steel segment, the pollutant removals for BAT-1 were 1,850,000 lbs/yr for conventional pollutants, 758,000 lbs/yr for nonconventional pollutants, and approximately 54,500 lbs/yr for priority pollutants. The pollutant removals for PSES-1 were 5,340 lbs/yr for nonconventional pollutants and 458 lbs/yr for priority pollutants. Tables 11-38 and 11-40 present the pollutant removals for direct and indirect dischargers, respectively, in the carbon and alloy steel segment.

For the stainless steel segment, the pollutant removals for BAT-1 were 844,000 lbs/yr for conventional pollutants, approximately 22,040,000 lbs/yr for nonconventional pollutants, and 36,800 lbs/yr for priority pollutants. The pollutant removals for PSES-1 were 127,900 lbs/yr for nonconventional pollutants and 323 lbs/yr for priority pollutants. Tables 11-39 and 11-41 present the pollutant removals for direct and indirect dischargers, respectively, in the stainless steel segment.

The flow reduction for the carbon and alloy steel segment direct dischargers was 11.7 billion gallons per year, a 44-percent reduction. The flow reduction for the carbon and alloy steel segment indirect dischargers was 305 million gallons per year, a 29-percent reduction. The flow reduction for the stainless steel segment direct dischargers was 2.84 billion gallons per year, a 46-percent reduction. The flow reduction for the stainless steel segment indirect dischargers was 57.6 million gallons per year, a 23-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the steel finishing subcategory, see the Pollutant Loadings and Removals for the Steel Finishing Subcategory memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10841.

11.13.3 Alternative Methodology to Estimate Pollutant Loadings and Removals for the Steel Finishing Subcategory

EPA performed an additional analysis for the steel finishing subcategory, carbon and alloy steel segment, to determine the pollutant loadings and removals using concentration-based limitations. EPA used the same general methodology to calculate pollutant loadings and removals for this analysis, except flow reductions were not calculated (i.e., the model PNFs were set equal to the baseline PNFs for all operations and sites).

Using this alternative methodology, for the carbon and alloy steel segment, the pollutant removals for BAT-1 were 94,500 lbs/yr for nonconventional and priority pollutants. For PSES-1, the pollutant removals were 766 lbs/yr for nonconventional and priority pollutants.

11.14 Pollutant Loadings and Removals for the Other Operations Subcategory

EPA calculated pollutant loadings for the one direct-reduced iron (DRI) site and five forging sites that generate and discharge process wastewater for the BPT option. These sites represent a total industry population of approximately nine sites for the BPT option. EPA did not calculate pollutant loadings for indirect dischargers because BPT limitations are not applicable.

For DRI, EPA estimated pollutant loadings for 7 of the 10 POCs. Three POCs were not included in the analysis for the following reasons: one POC was never detected in DRI effluent (listed in Table 11-1) and two POCs failed the influent editing criteria (listed in Table 11-2). See Section 14 for more information regarding the influent editing criteria. For forging, EPA estimated pollutant loadings and removals for O&G and TSS.

11.14.1 Methodology Used to Estimate Baseline Pollutant Loadings

EPA estimated baseline pollutant loadings for each facility using available site-specific and subcategory-specific average baseline pollutant concentrations, the baseline PNFs and the manufacturing operation production obtained from the industry surveys.

Determination of Site-Specific Average Baseline Pollutant Concentrations

EPA calculated site-specific average baseline pollutant concentrations to determine baseline pollutant loadings for each operation in the other operations subcategory. For the DRI segment, EPA used two effluent data sets from one direct discharger to calculate the site-specific average baseline pollutant concentrations. One site provided industry self-monitoring data, and EPA collected sampling data for the same site. For the forging segment, EPA used three effluent data sets from two direct dischargers to calculate the site-specific average baseline pollutant concentrations. Two sites provided industry self-monitoring data. One DRI site and one forging site submitted multiple data sets (i.e., the DRI site had industry self-monitoring data and EPA sampling data and one of the forging sites provided industry self-monitoring data and survey summary data) that represented one operation or where the wastewater for several operations was combined for treatment. To calculate the site-specific average baseline pollutant concentrations for the DRI site, EPA averaged the site's multiple data sets together. For the forging site, EPA used the industry self-monitoring data and when no industry self-monitoring data were available for a POC, EPA used survey summary data.

Determination of Subcategory-Specific Average Baseline Pollutant Concentrations

EPA used the subcategory-specific average baseline pollutant concentrations as a surrogate for site-specific average baseline pollutant concentrations when no data for a POC were available for an operation. To calculate the subcategory-specific average baseline pollutant concentrations for sites with forging operations, EPA used the three data sets from two sites. Table 11-42 presents the subcategory-specific average baseline pollutant concentrations for forging operations. EPA did not calculate subcategory-specific average baseline pollutant concentrations for sites with DRI operations because there was only one direct discharger with DRI operations, and this site supplied data for all the POCs.

Baseline Pollutant Loadings Calculation

Using the site-specific and subcategory-specific average baseline pollutant concentrations and baseline PNFs, EPA calculated baseline pollutant loadings for the other operations subcategory using Equations 11-1 and 11-3. Because EPA established only BPT limitations, EPA did not calculate baseline pollutant loadings for indirect dischargers. Tables 11-45 and 11-46 present the baseline pollutant loadings for the DRI and forging segments, respectively.

11.14.2 Methodology Used to Estimate Treated Pollutant Loadings and Pollutant Removals

EPA estimated treated pollutant loadings for the other operations subcategory using the model PNFs and LTAs as shown in Equation 11-4. Table 13-1 presents the model PNFs for this subcategory. For the DRI segment, EPA calculated model LTAs for regulated pollutants only. See DCN IS10933 in Section 14.10 of the rulemaking record for more information. For the remaining POCs, EPA calculated the arithmetic mean of BAT performance data. See DCN IS10895 in Section 14.10 of the rulemaking record for more information. Table 11-43 presents the arithmetic means of BAT performance data for the DRI segment. For the forging segment, EPA calculated the arithmetic mean of BAT performance data for each POC (presented in Table 11-44). See DCN IS10814 in Section 14.10 of the rulemaking record for more information. Because EPA established only BPT limitations, EPA did not calculate treated pollutant loadings for indirect dischargers. Tables 11-45 and 11-46 present the treated pollutant loadings for the DRI and forging segments, respectively.

EPA calculated pollutant removals for the other operations subcategory as the difference between the treated and baseline pollutant loadings using Equation 11-5. For DRI, the pollutant removals for BPT were 1,380 lbs/yr for conventional pollutants and approximately 5,680 lbs/yr nonconventional pollutants. For forging, the pollutant removals for BPT were 3,570 lbs/yr for conventional pollutants. Tables 11-45 and 11-46 present the pollutant removals for the DRI and forging segments, respectively.

For DRI, EPA estimated a 30-percent reduction in flow. For forging, EPA estimated flow reductions to be 4.6 million gallons per year, a 27-percent reduction.

For more information regarding the calculation of pollutant loadings and removals for the other operations subcategory, see the Pollutant Loadings and Removals for the Other Operations Subcategory memorandum in Section 14.7 of the Iron and Steel Rulemaking Record, DCN IS10843.

11.15 References

11-1 U.S. Environmental Protection Agency. Fate of Priority Pollutants in Publicly Owned Treatment Works. EPA 440/1-82/303, Washington, D.C., September 1982.

11-2 U.S. Environmental Protection Agency. National Risk Management Research Laboratory (NRMRL) Treatability Database Version 5.0. Cincinnati, OH, 1994.

11-3 American Public Health Association, American Water Works Association, and Water Environment Federation. Standard Methods for the Examination of Water and Wastewater 19th Edition, Washington, D.C., 1995.

11-4 U.S. Environmental Protection Agency. Development Document for Effluent Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category. Volume 1. EPA 440/1-82/024, Washington, D.C., May 1982.

Table 11-1

Pollutants of Concern Not Detected in Effluent at Any Site

Subcategory	Segment	Pollutant Group	Pollutant by Concern
Cokemaking	By-Product Recovery Cokemaking	Nonconventional pollutants, other (a)	Total petroleum hydrocarbons (TPH)
		Priority organic pollutants	Acenaphthene
			Acenaphthylene
			Anthracene
			Benzidine
			Benzo(ghi)perylene
			1,2-Dichloroethane
			Ethylbenzene
			Fluorene
			Indeno(1,2,3-cd)pyrene
			Toluene
		Nonconventional organic pollutants	2,3-benzofluorene
			beta-Naphthylamine
			Biphenyl
			2-Butanone
			Carbazole
			Carbon disulfide
			Dibenzothiophene
			4,5-Methylene phenanthrene
			1-Methylphenanthrene
			1-Naphthylamine
			m- + p-Xylene
			m-Xylene
			n-Hexadecane
			o- + p-Xylene
			o-Xylene
			Perylene

Table 11-1 (Continued)

Subcategory	Segment	Pollutant Group	Pollutant by Concern
Cokemaking (cont.)	By-Product Recovery Cokemaking (cont.)	Nonconventional organic pollutants (cont.)	2-Picoline
			Styrene
			Thianaphthene
	Non-recovery Cokemaking	NA	NA
Ironmaking	Blast Furnace Ironmaking	Nonconventional pollutants, other (a)	Total petroleum hydrocarbons (TPH)
		Nonconventional organic pollutants	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
	Sintering	Nonconventional pollutants, other (a)	Total petroleum hydrocarbons (TPH)
		Priority metals	Silver
		Priority organic pollutants	Benzo(a)anthracene
			Benzo(a)pyrene
			Benzo(b)fluoranthene
			Benzo(k)fluoranthene
			Chrysene
			Pyrene
		Nonconventional organic pollutants	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
			1,2,3,4,7,8,9-Heptachlorodibenzofuran
			1,2,3,7,8,9-Hexachlorodibenzofuran
			1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
			1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin
			1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
			n-Docosane
			n-Eicosane
			n-Hexadecane
			n-Octadecane
			n-Tetracosane
			Octachlorodibenzofuran
			Octachlorodibenzo-p-dioxin
			1,2,3,7,8-Pentachlorodibenzo-p-dioxin

Table 11-1 (Continued)

Subcategory	Segment	Pollutant Group	Pollutant by Concern
Integrated Steelmaking	NA	Priority metals	Beryllium
			Nickel
Integrated and Stand-Alone Hot Forming	Carbon and Alloy Steel	(b)	(b)
	Stainless Steel	(b)	(b)
Non-Integrated Steelmaking and Hot Forming	Carbon and Alloy Steel	(b)	(b)
	Stainless Steel	Priority organic pollutants	Tribromomethane
Finishing	Carbon and Alloy Steel	Priority metals	Selenium
		Priority organic pollutants	1,1,1-Trichloroethane
		Nonconventional organic pollutants	Benzoic acid
			n-Eicosane
			n,n-Dimethylformamide
			n-Octadecane
			n-Tetradecane
	Stainless Steel	Priority metals	Cadmium
			Selenium
		Nonconventional metals	Vanadium
		Priority organic pollutants	Ethylbenzene
			Naphthalene
			Phenol
			Toluene
		Nonconventional organic pollutants	Benzoic acid
			2,6-Di-tert-butyl-p-benzoquinone
			2-Methylnaphthalene
			m-Xylene
			n-Docosane
			n-Eicosane
			n-Octadecane
			n-Tetracosane

Table 11-1 (Continued)

Subcategory	Segment	Pollutant Group	Pollutant by Concern
Finishing (cont.)	Stainless Steel (cont.)	Nonconventional organic pollutants (cont.)	n-Tetradecane
			o- + p-Xylene
Other Operations	DRI	Nonconventional metals	Titanium
	Forging	(c)	(c)

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) No POCs were excluded for this segment.
(c) EPA did not identify POCs for forging.

NA - Not applicable.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-2

Pollutants of Concern That Failed the Influent Editing Criteria

Subcategory	Segment	Pollutant Group	Pollutant of Concern
Cokemaking	By-Product Recovery Cokemaking	Priority metals	Arsenic
		Nonconventional metals	Boron
		Priority organic pollutants	Benzo(k)fluoranthene
		Nonconventional organic pollutants	o-Toluidine
	Non-recovery Cokemaking	NA	NA
Ironmaking	Blast Furnace Ironmaking	(a)	(a)
	Sintering	(a)	(a)
Integrated Steelmaking	NA	Conventional pollutants	Oil and grease (O&G)
		Nonconventional pollutants, other (b)	Total petroleum hydrocarbons (TPH)
		Priority metals	Antimony
			Mercury
			Silver
		Nonconventional metals	Cobalt
		Priority organic pollutants	Phenol
Integrated and Stand-Alone Hot Forming	Carbon and Alloy Steel	(a)	(a)
	Stainless Steel	(a)	(a)
Non-Integrated Steelmaking and Hot Forming	Carbon and Alloy Steel	(c)	(c)
	Stainless Steel	(a)	(a)
Finishing	Carbon and Alloy Steel	(a)	(a)
	Stainless Steel	(a)	(a)

Table 11-2 (Continued)

Subcategory	Segment	Pollutant Group	Pollutant of Concern
Other Operations	DRI	Conventional pollutants	Oil and grease (O&G)
		Nonconventional pollutants, other (b)	Total petroleum hydrocarbons (TPH)
	Forging	(d)	(d)

(a) EPA did not apply the influent editing criteria to these segments. See Section 14.7, DCN IS10834 in the rulemaking record for a detailed discussion of application of the influent editing criteria.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(c) EPA did not apply the influent editing criteria to the non-integrated steelmaking and hot forming carbon and alloy segment because paired data were not available.
(d) EPA did not identify POCs for forging.

NA - Not applicable.

Note: This table does not include POCs listed in Table 11-1.

Table 11-3

POTW Percent Removals

Pollutant	Percent Removal	Data Source
Conventional Pollutants		
Biochemical oxygen demand 5-day (BOD_5) - carbonaceous	91%	Transfer from BOD_5 (50-POTW Study - data >10 × ML)
Oil and grease (O&G)	87%	Used O&G percent removal (50-POTW Study - data >10 × ML)
Total suspended solids (TSS)	90%	50-POTW Study - data >10 × ML
Nonconventional Pollutants, Other (a)		
Amenable cyanide	93%	Transfer from WAD cyanide
Ammonia as nitrogen	39%	50-POTW Study - data >10 × ML
Chemical oxygen demand (COD)	81%	50-POTW Study - data >10 × ML
Fluoride	54%	NRMRL Treatability Database (all wastewaters)
Nitrate/nitrite (NO2 + NO3-N)	90%	Transfer from TKN
Thiocyanate	70%	Transfer from total cyanide
Total Kjeldahl nitrogen (TKN)	90%	Based on data from POTWs receiving iron and steel wastewater
Total petroleum hydrocarbons (TPH)	87%	Used O&G percent removal (50-POTW Study - data >10 × ML)
Total organic carbon (TOC)	70%	50-POTW Study - data >10 × ML
Total phenols	77%	50-POTW Study - data >10 × ML
Weak acid dissociable (WAD) cyanide	93%	Based on data from POTW receiving iron and steel wastewater
Priority Metals		
Antimony	67%	50-POTW Study - data >2 × ML
Arsenic	66%	50-POTW Study - data >2 × ML
Beryllium	61%	NRMRL Treatability Database (industrial wastewater)
Cadmium	90%	50-POTW Study - data >10 × ML
Chromium	80%	50-POTW Study - data >10 × ML
Copper	84%	50-POTW Study - data >10 × ML
Lead	77%	50-POTW Study - data >10 × ML
Mercury	90%	50-POTW Study - data >10 × ML
Nickel	51%	50-POTW Study - data >10 × ML
Selenium	34%	NRMRL Treatability Database (domestic wastewater)
Silver	88%	50-POTW Study - data >10 × ML
Thallium	54%	NRMRL Treatability Database (all wastewater)
Zinc	79%	50-POTW Study - data >10 × ML

Table 11-3 (Continued)

Pollutant	Percent Removal	Data Source
Nonconventional Metals		
Aluminum	91%	50-POTW Study - data >10 × ML
Barium	55%	50-POTW Study - data >2 × ML
Boron	24%	50-POTW Study - data >2 × ML
Cobalt	10%	50-POTW Study - data >2 × ML
Hexavalent chromium	6%	NRMRL Treatability Database (all wastewater)
Iron	82%	50-POTW Study - data >10 × ML
Magnesium	14%	50-POTW Study - data >10 × ML
Manganese	36%	50-POTW Study - data >10 × ML
Molybdenum	19%	50-POTW Study - data >10 × ML
Tin	43%	50-POTW Study - data >2 × ML
Titanium	92%	50-POTW Study - data >10 × ML
Vanadium	8%	50-POTW Study - data >2 × ML
Priority Organic Pollutants		
Benzene	95%	50-POTW Study - data >10 × ML
Benzo(a)anthracene	98%	NRMRL Treatability Database (domestic wastewater)
Benzo(a)pyrene	95%	NRMRL Treatability Database (all wastewater)
Benzo(b)fluoranthene	95%	NRMRL Treatability Database (all wastewater)
Benzo(k)fluoranthene	95%	NRMRL Treatability Database (all wastewater)
Bis(2-ethylhexyl) phthalate	60%	50-POTW Study - data >10 × ML
Chrysene	97%	NRMRL Treatability Database (domestic wastewater)
2,4-Dimethylphenol	51%	50-POTW Study - data >2 × ML
Fluoranthene	42%	50-POTW Study - data >2 × ML
Naphthalene	95%	50-POTW Study - data >10 × ML
Phenanthrene	95%	50-POTW Study - data >10 × ML
Phenol	95%	50-POTW Study - data >10 × ML
Pyrene	84%	NRMRL Treatability Database (domestic wastewater)
Nonconventional Organic Pollutants		
alpha-Terpineol	94%	NRMRL Treatability Database (industrial wastewater)
Aniline	93%	NRMRL Treatability Database (all wastewater)
Benzyl alcohol	78%	NRMRL Treatability Database (all wastewater)
Carbazole	62%	CWT Project: Generic Removal Group: Anilines
Dibenzofuran	98%	NRMRL Treatability Database (all wastewater)
Hexanoic acid	84%	NRMRL Treatability Database (all wastewater)
2-Methylnaphthalene	28%	NRMRL Treatability Database (industrial wastewater)
n-Dodecane	95%	NRMRL Treatability Database (industrial wastewater)
n-Eicosane	92%	NRMRL Treatability Database (industrial wastewater)

Table 11-3 (Continued)

Pollutant	Percent Removal	Data Source
Nonconventional Organic Pollutants (cont.)		
n-Hexadecane	71%	CWT Project: Generic Removal Group: n-Pariffins
n-Octadecane	71%	CWT Project: Generic Removal Group: n-Pariffins
o-Cresol	53%	NRMRL Treatability Database (industrial wastewater)
o-Toluidine	93%	Transfer from aniline
p-Cresol	72%	NRMRL Treatability Database (industrial wastewater)
2-Phenylnaphthalene	85%	Centralized Water Treaters (CWT) Project - no source listed
2-Propanone	84%	NRMRL Treatability Database (all wastewater)
Pyridine	95%	NRMRL Treatability Database (industrial wastewater)
2,3,7,8-Tetrachlorodibenzofuran	83%	Transfer from 1,2,3,4,6,7,8-HPCDF (Source: NRMRL)
Other Priority Pollutants		
Total cyanide	70%	50-POTW Study - data >10 × ML

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA's Fate of Priority Pollutants in Publicly Owned Treatment Works and U.S. EPA's NRMRL Treatability Database (References 11-1 and 11-2).

Table 11-4

Subcategory-Specific Average Baseline Pollutant Concentrations for the Cokemaking Subcategory By-Product Recovery Cokemaking Segment (a)

Pollutant of Concern	Type of Discharge	Ammonia Stills Subcategory-Specific Average Baseline Concentration (mg/L)	Ammonia Stills and Biological Treatment Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants			
Biochemical oxygen demand 5-day (BOD_5) - carbonaceous	Direct	(b)	69.4
	Indirect	1,220	69.4 (c)
Oil and grease (O&G)	Direct	(b)	5.15
	Indirect	21.8	5.15 (c)
Total suspended solids (TSS)	Direct	(b)	52.5
	Indirect	69.8	143
Nonconventional Pollutants, Other (d)			
Ammonia as nitrogen	Direct, Indirect	95.6	52.9
Chemical oxygen demand (COD)	Direct, Indirect	2,414	357
Nitrate/nitrite	Direct, Indirect	0.670	81.2
Thiocyanate	Direct, Indirect	234	6.45
Total Kjeldahl nitrogen (TKN)	Direct, Indirect	190	87.7
Total organic carbon (TOC)	Direct, Indirect	798	27.7
Total phenols	Direct, Indirect	277	2.01
Weak acid dissociable (WAD) cyanide	Direct, Indirect	0.974	2.58
Priority Metals			
Mercury	Direct, Indirect	0.00179	0.000473
Selenium	Direct, Indirect	0.826	0.496
Priority Organic Pollutants			
Benzene	Direct, Indirect	0.0106	0.00512
Benzo(a)anthracene	Direct, Indirect	0.0686	0.0125
Benzo(a)pyrene	Direct, Indirect	0.0683	0.0112
Benzo(b)fluoranthene	Direct, Indirect	0.0610	0.00761
Chrysene	Direct, Indirect	0.0756	0.0123
2,4-Dimethylphenol	Direct, Indirect	1.77	0.00910

Table 11-4 (Continued)

Pollutant of Concern	Type of Discharge	Ammonia Stills Subcategory-Specific Average Baseline Concentration (mg/L)	Ammonia Stills and Biological Treatment Subcategory-Specific Average Baseline Concentration (mg/L)
Priority Organic Pollutants (cont.)			
Fluoranthene	Direct, Indirect	0.0834	0.0150
Naphthalene	Direct, Indirect	0.0504	0.0117
Phenanthrene	Direct, Indirect	0.0553	0.00910
Phenol	Direct, Indirect	131	0.0276
Pyrene	Direct, Indirect	0.0661	0.0139
Nonconventional Organic Pollutants			
Aniline	Direct, Indirect	2.93	0.0102
Dibenzofuran	Direct, Indirect	0.0338	0.0101
2-Methylnaphthalene	Direct, Indirect	0.0336	0.0147
n-Eicosane	Direct, Indirect	0.191	0.0101
n-Octadecane	Direct, Indirect	0.386	0.0101
o-Cresol	Direct, Indirect	12.3	0.0120
p-Cresol	Direct, Indirect	71.4	0.0103
2-Phenylnaphthalene	Direct, Indirect	0.0676	0.0102
2-Propanone	Direct, Indirect	0.0547	0.0506
Pyridine	Direct, Indirect	0.160	0.0103
Other Priority Pollutants			
Total cyanide	Direct, Indirect	2.80	5.58

(a) EPA used these averages for the BAT-1 and PSES-1 options only.
(b) All of the sites that have ammonia still treatment only are indirect dischargers.
(c) For these conventional pollutants, no data were available for indirect sites; therefore, EPA used the average baseline concentration for the direct discharging sites for indirect discharging sites.
(d) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-5

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the By-Product Recovery Cokemaking Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-3 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)	BAT-3 Pollutant Removals (lbs/yr) (a)
Conventional Pollutants					
Biochemical oxygen demand 5-day (BOD_5) - carbonaceous	1,250,000	907,000	735,000	343,000	674,000
Oil and grease (O&G)	90,600	87,600	87,600	2,980	2,980
Total suspended solids (TSS)	593,000	593,000	203,000	0	390,000
Total Conventional Pollutants	**1,930,000**	**1,590,000**	**1,030,000**	**346,000**	**1,070,000**
Nonconventional Pollutants, Other (b)					
Ammonia as nitrogen	453,000	35,700	4,370	417,000	448,000
Chemical oxygen demand (COD)	3,650,000	985,000	853,000	2,670,000	2,800,000
Nitrate/nitrite	1,740,000	1,740,000	1,400,000	0	331,000
Thiocyanate	311,000	10,200	10,200	301,000	301,000
Total Kjeldahl nitrogen (TKN)	1,140,000	491,000	465,000	653,000	680,000
Total organic carbon (TOC)	379,000	260,000	255,000	119,000	124,000
Total phenols	1,720	742	539	979	1,180
Weak acid dissociable (WAD) cyanide	37,400	37,100	35,400	363	363
Total Nonconventional Pollutants, Other (c)	**2,500,000**	**1,790,000**	**1,410,000**	**718,000**	**1,080,000**
Priority Metals					
Mercury	4.71	3.41	3.34	1.31	1.38
Selenium	4,800	3,260	3,170	1,550	1,630
Total Priority Metals	**4,800**	**3,260**	**3,170**	**1,550**	**1,630**
Priority Organic Pollutants					
Benzene	78.7	67.5	70	11.3	11.8
Benzo(a)anthracene	178	156	154	21.4	4.67
Benzo(b)fluoranthene	138	136	135	2.62	3.39
Benzo(a)pyrene	164	135	134	29.3	28.8
Chrysene	176	156	154	20	4.67
2,4-Dimethylphenol	154	151	158	3.42	4.57

Table 11-5 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-3 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)	BAT-3 Pollutant Removals (lbs/yr) (a)
Priority Organic Pollutants (cont.)					
Fluoranthene	198	159	156	39.6	4.26
Naphthalene	184	163	144	21.7	47
Phenanthrene	154	151	158	3.42	4.57
Phenol	320	192	158	128	163
Pyrene	190	158	156	31.5	4.26
Total Priority Organic Pollutants	**1,930**	**1,620**	**1,580**	**312**	**281**
Nonconventional Organic Pollutants					
Aniline	164	158	158	5.54	6.1
o-Cresol	180	156	155	23.6	25
p-Cresol	160	154	154	5.15	5.72
Dibenzofuran	162	158	158	4.08	4.57
n-Eicosane	162	158	157	4.36	5.17
2-Methylnaphthalene	216	161	158	54.9	57.2
n-Octadecane	162	158	157	4.36	5.17
2-Phenylnaphthalene	163	159	159	3.77	3.78
2-Propanone	811	787	786	24.2	24.5
Pyridine	165	158	158	6.28	6.86
Total Nonconventional Organic Pollutants	**2,350**	**2,210**	**2,200**	**136**	**144**
Other Priority Pollutants					
Total cyanide	74,400	46,100	19,600	28,300	55,000

(a) BAT-3 pollutant removals were calculated using a previous version of the estimated baseline pollutant loadings. Hence, the listed pollutant removals do not exactly reflect the difference between the baseline pollutant loadings and the BAT-3 treated pollutant loadings. This minor inconsistency has no impact on EPA's decisions for this industry segment for the final rule. See document number IS10831 in Section 14.7 of the rulemaking record for further information.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(c) Total does not include COD, TKN, TOC, total phenols, or WAD cyanide.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-6

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the By-Product Recovery Cokemaking Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-3 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)	PSES-3 Pollutant Removals (lbs/yr) (a)
Nonconventional Pollutants, Other (b)					
Ammonia as nitrogen	301,000	106,000	8,050	195,000	293,000
Chemical oxygen demand (COD)	1,440,000	998,000	64,600	443,000	1,380,000
Nitrate/nitrite	15,600	15,600	15,600	28.1	28.1
Thiocyanate	193,000	172,000	1,410	20,900	191,000
Total Kjeldahl nitrogen (TKN)	73,600	65,600	13,900	8,040	59,700
Total organic carbon (TOC)	732,000	598,000	23,600	134,000	709,000
Total phenols	204,000	166,000	34.7	38,600	204,000
Weak acid dissociable (WAD) cyanide	411	383	383	28	28
Total Nonconventional Pollutants, Other (c)	**510,000**	**294,000**	**25,100**	**216,000**	**484,000**
Priority Metals					
Mercury	0.618	0.484	0.112	0.134	0.506
Selenium	2,400	2,170	908	228	1,490
Total Priority Metals	**2,400**	**2,170**	**908**	**228**	**1,490**
Priority Organic Pollutants					
Benzene	2.01	1.4	1.14	0.605	0.897
Benzo(a)anthracene	4.58	3.86	0.894	0.718	3.6
Benzo(b)fluoranthene	9.85	7.84	2.01	2.01	7.84
Benzo(a)pyrene	11.3	6.96	2.24	4.33	9.04
Chrysene	7.49	6.1	1.34	1.39	6.02
2,4-Dimethylphenol	2,600	1,390	22	1,210	2,580
Fluoranthene	161	82.7	26	78.6	130
Naphthalene	8.01	4.08	2.25	3.93	5.81
Phenanthrene	9.14	5.74	2.24	3.39	6.99
Phenol	15,200	15,200	2.24	0	15,200
Pyrene	35.9	20.7	7.18	15.2	27.5
Total Priority Organic Pollutants	**18,000**	**16,700**	**69.5**	**1,320**	**18,000**

Table 11-6 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-3 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)	PSES-3 Pollutant Removals (lbs/yr) (a)
Nonconventional Organic Pollutants					
Aniline	615	492	3.14	123	612
o-Cresol	17,300	14,900	21.1	2,420	17,300
p-Cresol	59,800	18,900	12.6	41,000	59,800
Dibenzofuran	2.41	1.93	0.898	0.477	1.51
n-Eicosane	47.3	36	3.58	11.2	43.7
2-Methylnaphthalene	92.5	48.5	32.4	44	60.1
n-Octadecane	341	114	13	226	328
2-Phenylnaphthalene	33.2	29	6.82	4.25	26.4
2-Propanone	41.6	36.4	35.8	5.16	5.79
Pyridine	24.9	11	2.24	13.9	22.7
Total Nonconventional Organic Pollutants	**78,300**	**34,600**	**132**	**43,800**	**78,200**
Other Priority Pollutants					
Total cyanide	8,130	5,290	3,280	2,840	4,860

(a) PSES-3 pollutant removals were calculated using a previous version of the estimated baseline pollutant loadings. Hence, the listed pollutant removals do not exactly reflect the difference between the baseline pollutant loadings and the PSES-3 treated pollutant loadings. This minor inconsistency has no impact on EPA's decisions for this industry segment for the final rule. See document number IS10831 in Section 14.7 of the rulemaking record for further information.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(c) Total does not include COD, TKN, TOC, total phenols, or WAD cyanide.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-7

Subcategory-Specific Average Baseline Pollutant Concentrations for the Ironmaking Subcategory Blast Furnace Wastewater Only

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	5.54
	Indirect	5.54 (a)
Total suspended solids (TSS)	Direct	34.8
	Indirect	34.8 (a)
Nonconventional Pollutants, Other (b)		
Amenable cyanide	Direct, Indirect	0.105
Ammonia as nitrogen	Direct, Indirect	60.1
Chemical oxygen demand (COD)	Direct, Indirect	274
Fluoride	Direct, Indirect	9.89
Nitrate/nitrite	Direct, Indirect	2.45
Thiocyanate	Direct, Indirect	0.148
Total Kjeldahl nitrogen (TKN)	Direct, Indirect	112
Total organic carbon (TOC)	Direct, Indirect	12.6
Weak acid dissociable (WAD) cyanide	Direct, Indirect	0.0150
Priority Metals		
Chromium	Direct, Indirect	0.00691
Copper	Direct, Indirect	0.00654
Lead	Direct, Indirect	0.0541
Nickel	Direct, Indirect	0.0214
Selenium	Direct, Indirect	0.003
Zinc	Direct, Indirect	0.779
Nonconventional Metals		
Aluminum	Direct, Indirect	0.171
Boron	Direct, Indirect	1.21
Iron	Direct, Indirect	4.29
Magnesium	Direct, Indirect	59.5
Manganese	Direct, Indirect	1.76
Molybdenum	Direct, Indirect	0.0408
Titanium	Direct, Indirect	0.00380

Table 11-7 (Continued)

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Other Priority Pollutants		
Total cyanide	Direct, Indirect	0.606

(a) The indirect discharger did not provide data for these conventional POCs; therefore, EPA used the average baseline concentrations for the direct dischargers.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-8

Subcategory-Specific Average Baseline Pollutant Concentrations for the Ironmaking Subcategory
Commingled Blast Furnace and Sintering Wastewater

Pollutant of Concern	Type of Discharge (a)	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	5.88
Total suspended solids (TSS)	Direct	28.7
Nonconventional Pollutants, Other (b)		
Amenable cyanide	Direct	0.0240
Ammonia as nitrogen	Direct	58.8
Chemical oxygen demand (COD)	Direct	42.6
Fluoride	Direct	14.1
Nitrate/nitrite	Direct	7.29
Thiocyanate	Direct	0.116
Total Kjeldahl nitrogen (TKN)	Direct	51.6
Total organic carbon (TOC)	Direct	12.9
Total phenols	Direct	0.0431
Weak acid dissociable (WAD) cyanide	Direct	0.0179
Priority Metals		
Arsenic	Direct	0.00460
Cadmium	Direct	0.00627
Chromium	Direct	0.0151
Copper	Direct	0.00798
Lead	Direct	0.0374
Mercury	Direct	0.000221
Nickel	Direct	0.0159
Selenium	Direct	0.00701
Thallium	Direct	0.0577
Zinc	Direct	0.611
Nonconventional Metals		
Aluminum	Direct	0.586
Boron	Direct	0.363
Iron	Direct	2.62
Magnesium	Direct	27.1

Table 11-8 (Continued)

Pollutant of Concern	Type of Discharge (a)	Subcategory-Specific Average Baseline Concentration (mg/L)
Nonconventional Metals (cont.)		
Manganese	Direct	0.307
Molybdenum	Direct	0.0381
Titanium	Direct	0.00160
Priority Organic Pollutants		
2,4-Dimethylphenol	Direct	0.0100
Fluoranthene	Direct	0.0100
4-Nitrophenol	Direct	0.0500
Phenanthrene	Direct	0.0100
Phenol	Direct	0.0100
Nonconventional Organic Pollutants		
1,2,3,4,6,7,8-Heptachlorodibenzofuran	Direct	1.24E-07
1,2,3,4,7,8-Hexachlorodibenzofuran	Direct	9.40E-08
1,2,3,6,7,8-Hexachlorodibenzofuran	Direct	8.24E-08
2,3,4,6,7,8-Hexachlorodibenzofuran	Direct	6.80E-08
o-Cresol	Direct	0.0100
p-Cresol	Direct	0.0100
1,2,3,7,8-Pentachlorodibenzofuran	Direct	9.16E-08
2,3,4,7,8-Pentachlorodibenzofuran	Direct	1.27E-07
Pyridine	Direct	0.0215
2,3,7,8-Tetrachlorodibenzofuran	Direct	8.13E-08
Other Priority Pollutants		
Total cyanide	Direct	0.0696

(a) Sites with commingled blast furnace and sintering wastewater included only direct dischargers; therefore, EPA did not calculate average baseline pollutant concentrations for indirect dischargers.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Note: For sites with commingled blast furnace and sintering wastewater, EPA combined the POCs for the blast furnace and sintering segments.

Table 11-9

Arithmetic Means of BAT Performance Data for the Ironmaking Subcategory Blast Furnace Wastewater Only

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	BAT-1	5.88 (a)
	PSES-1	5.88 (a)
Total suspended solids (TSS)	BAT-1	18.7
	PSES-1	18.7
Nonconventional Pollutants, Other (b)		
Amenable cyanide	BAT-1	0.0244
	PSES-1	0.0244
Ammonia as nitrogen	BAT-1	0.280 (a)
	PSES-1	72.5 (a)
Chemical oxygen demand (COD)	BAT-1	42.9
	PSES-1	42.9
Fluoride	BAT-1	14.0
	PSES-1	14.0
Nitrate/nitrite	BAT-1	7.31
	PSES-1	7.31
Thiocyanate	BAT-1	0.118
	PSES-1	0.118
Total Kjeldahl nitrogen (TKN)	BAT-1	65.7
	PSES-1	65.7
Total organic carbon (TOC)	BAT-1	13.2
	PSES-1	13.2
Weak acid dissociable (WAD) cyanide	BAT-1	0.0171
	PSES-1	0.0171
Priority Metals		
Chromium	BAT-1	0.0149
	PSES-1	0.0149
Copper	BAT-1	0.00840
	PSES-1	0.00840
Lead	BAT-1	0.00338
	PSES-1	0.0169

Table 11-9 (Continued)

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Priority Metals (cont.)		
Nickel	BAT-1	0.0160
	PSES-1	0.0160
Selenium	BAT-1	0.00750
	PSES-1	0.00750
Zinc	BAT-1	0.0368 (a)
	PSES-1	0.843 (a)
Nonconventional Metals		
Aluminum	BAT-1	0.586
	PSES-1	0.586
Boron	BAT-1	0.365
	PSES-1	0.365
Iron	BAT-1	2.58
	PSES-1	2.58
Magnesium	BAT-1	27.1
	PSES-1	27.1
Manganese	BAT-1	0.308
	PSES-1	0.308
Molybdenum	BAT-1	0.0386
	PSES-1	0.0386
Titanium	BAT-1	0.00160
	PSES-1	0.00160
Other Priority Pollutants		
Total cyanide	BAT-1	1.45 (a)
	PSES-1	0.0725

(a) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-10

Arithmetic Means of BAT Performance Data for the Ironmaking Subcategory Commingled Blast Furnace and Sintering Wastewater

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Hexane extractable material (HEM)	BAT-1	5.88 (a)
	PSES-1	5.88 (a)
Total suspended solids (TSS)	BAT-1	18.7
	PSES-1	18.7
Nonconventional Pollutants, Other (b)		
Amenable cyanide	BAT-1	0.0244
	PSES-1	0.0244
Ammonia as nitrogen	BAT-1	0.280 (a)
	PSES-1	72.5 (a)
Chemical oxygen demand (COD)	BAT-1	42.9
	PSES-1	42.9
Fluoride	BAT-1	14.0
	PSES-1	14.0
Nitrate/nitrite	BAT-1	7.31
	PSES-1	7.31
Thiocyanate	BAT-1	0.118
	PSES-1	0.118
Total Kjeldahl nitrogen (TKN)	BAT-1	65.7
	PSES-1	65.7
Total organic carbon (TOC)	BAT-1	13.2
	PSES-1	13.2
Total phenols	BAT-1	0.0100 (a)
	PSES-1	0.0100
Weak acid dissociable (WAD) cyanide	BAT-1	0.0171
	PSES-1	0.0171
Priority Metals		
Arsenic	BAT-1	0.00460
	PSES-1	0.00460
Cadmium	BAT-1	0.00636
	PSES-1	0.00636
Chromium	BAT-1	0.0149
	PSES-1	0.0149

Table 11-10 (Continued)

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Priority Metals (cont.)		
Copper	BAT-1	0.00840
	PSES-1	0.00840
Lead	BAT-1	0.00338
	PSES-1	0.0169
Mercury	BAT-1	0.000223
	PSES-1	0.000223
Nickel	BAT-1	0.0160
	PSES-1	0.0160
Selenium	BAT-1	0.00750
	PSES-1	0.00750
Thallium	BAT-1	0.0578
	PSES-1	0.0578
Zinc	BAT-1	0.0368 (a)
	PSES-1	0.843 (a)
Nonconventional Metals		
Aluminum	BAT-1	0.586
	PSES-1	0.586
Boron	BAT-1	0.365
	PSES-1	0.365
Iron	BAT-1	2.58
	PSES-1	2.58
Magnesium	BAT-1	27.1
	PSES-1	27.1
Manganese	BAT-1	0.308
	PSES-1	0.308
Molybdenum	BAT-1	0.0386
	PSES-1	0.0386
Titanium	BAT-1	0.00160
	PSES-1	0.00160
Priority Organic Pollutants		
Fluoranthene	BAT-1	0.0100
	PSES-1	0.0100
Phenanthrene	BAT-1	0.0100
	PSES-1	0.0100
Phenol	BAT-1	0.0100
	PSES-1	0.0100

Table 11-10 (Continued)

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Priority Organic Pollutants (cont.)		
2,4-Dimethylphenol	BAT-1	0.0100
	PSES-1	0.0100
4-Nitrophenol	BAT-1	0.0500
	PSES-1	0.0500
Nonconventional Organic Pollutants		
o-Cresol	BAT-1	0.0100
	PSES-1	0.0100
p-Cresol	BAT-1	0.0100
	PSES-1	0.0100
Pyridine	BAT-1	0.0193
	PSES-1	0.0193
1,2,3,4,6,7,8-Heptachlorodibenzofuran	BAT-1	5.0E-08
	PSES-1	5.0E-08
1,2,3,4,7,8-Hexachlorodibenzofuran	BAT-1	5.0E-08
	PSES-1	5.0E-08
1,2,3,6,7,8-Hexachlorodibenzofuran	BAT-1	5.0E-08
	PSES-1	5.0E-08
2,3,4,6,7,8-Hexachlorodibenzofuran	BAT-1	5.0E-08
	PSES-1	5.0E-08
1,2,3,7,8-Pentachlorodibenzofuran	BAT-1	5.0E-08
	PSES-1	5.0E-08
2,3,4,7,8-Pentachlorodibenzofuran	BAT-1	5.0E-08
	PSES-1	5.0E-08
2,3,7,8-Tetrachlorodibenzofuran	BAT-1	1.0E-08 (a)
	PSES-1	1.0E-08 (a)
Other Priority Pollutants		
Total cyanide	BAT-1	1.45 (a)
	PSES-1	0.0725

(a) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-11

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Ironmaking Subcategory Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	452,000	63,600	389,000
Total suspended solids (TSS)	2,380,000	153,000	2,230,000
Total Conventional Pollutants	**2,830,000**	**217,000**	**2,620,000**
Nonconventional Pollutants, Other (a)			
Amenable cyanide	6,130	263	5,870
Ammonia as nitrogen	4,770,000	3,090	4,760,000
Chemical oxygen demand (COD)	15,300,000	471,000	14,800,000
Fluoride	912,000	140,000	773,000
Nitrate/nitrite	333,000	62,100	270,000
Thiocyanate	10,900	1,290	9,650
Total Kjeldahl nitrogen (TKN)	7,230,000	618,000	6,610,000
Total organic carbon (TOC)	1,020,000	141,000	875,000
Total phenols	1,250	74.5	1,180
Weak acid dissociable (WAD) cyanide	1,280	180	1,100
Total Nonconventional Pollutants, Other (b)	**6,030,000**	**206,000**	**5,810,000**
Priority Metals			
Arsenic	135	34.3	101
Cadmium	185	46.7	138
Chromium	783	133	649
Copper	580	83	497
Lead	3,970	37.3	3,930
Mercury	6.34	1.65	4.7
Nickel	1,550	172	1,380
Selenium	367	63.1	304
Thallium	1,790	430	1,360
Zinc	55,600	404	55,200
Total Priority Metals	**65,000**	**1,410**	**63,600**

Table 11-11 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Nonconventional Metals			
Aluminum	25,600	4,980	20,600
Boron	72,800	4,010	68,800
Iron	295,000	28,200	267,000
Magnesium	3,840,000	299,000	3,540,000
Manganese	100,000	3,390	96,900
Molybdenum	3,170	414	2,760
Titanium	245	17.6	227
Total Nonconventional Metals	**4,340,000**	**340,000**	**4,000,000**
Priority Organic Pollutants			
2,4-Dimethylphenol	289	74.5	215
Fluoranthene	286	74.5	211
4-Nitrophenol	1,490	373	1,120
Phenanthrene	287	74.5	212
Phenol	289	74.5	215
Total Priority Organic Pollutants	**2,640**	**671**	**1,970**
Nonconventional Organic Pollutants			
2,3,7,8-Tetrachlorodibenzofuran	0.000616	0.0000745	0.000542
1,2,3,7,8-Pentachlorodibenzofuran	0.00157	0.000373	0.0012
2,3,4,7,8-Pentachlorodibenzofuran	0.0017	0.000373	0.00133
1,2,3,4,7,8-Hexachlorodibenzofuran	0.00158	0.000373	0.00121
1,2,3,6,7,8-Hexachlorodibenzofuran	0.00154	0.000373	0.00117
2,3,4,6,7,8-Hexachlorodibenzofuran	0.00149	0.000373	0.00112
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.00169	0.000373	0.00132
o-Cresol	285	74.5	211
p-Cresol	286	74.5	212
Pyridine	646	144	502
Total Nonconventional Organic Pollutants	**1,220**	**293**	**925**
Other Priority Pollutants			
Total cyanide	38,000	2,960	35,000

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include amenable cyanide, COD, TKN, TOC, total phenols, or WAD cyanide.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-12

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Ironmaking Subcategory Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Amenable cyanide	4.86	0.344	4.52
Ammonia as nitrogen	14,400	4,390	10,000
Chemical oxygen demand (COD)	34,400	1,640	32,800
Fluoride	3,010	917	2,090
Nitrate/nitrite	162	49.4	113
Thiocyanate	29.4	7.14	22.2
Total Kjeldahl nitrogen (TKN)	7,410	1,320	6,080
Total organic carbon (TOC)	2,500	762	1,740
Weak acid dissociable (WAD) cyanide	0.694	0.212	0.483
Total Nonconventional Pollutants, Other (b)	**17,600**	**5,360**	**12,200**
Priority Metals			
Chromium	0.914	0.279	0.635
Copper	0.692	0.211	0.481
Lead	15.2	0.784	14.4
Nickel	6.93	1.58	5.35
Selenium	1.31	0.399	0.91
Zinc	11.1	3.39	7.72
Total Priority Metals	**36.1**	**6.64**	**29.5**
Nonconventional Metals			
Aluminum	10.2	3.1	7.07
Boron	608	55.9	552
Iron	511	93.6	417
Magnesium	33,800	4,700	29,100
Manganese	745	39.7	705
Molybdenum	21.9	6.3	15.6
Titanium	0.201	0.0258	0.175
Total Nonconventional Metals	**35,700**	**4,900**	**30,800**

Table 11-12 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Other Priority Pollutants			
Total cyanide	51.6	4.38	47.2

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include amenable cyanide, COD, TKN, TOC, or WAD cyanide.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-13

Subcategory-Specific Average Baseline Pollutant Concentrations for the Sintering Subcategory Commingled Blast Furnace and Sintering Wastewater

Pollutant of Concern	Type of Discharge (a)	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	5.88
Total suspended solids (TSS)	Direct	28.7
Nonconventional Pollutants, Other (b)		
Amenable cyanide	Direct	0.0240
Ammonia as nitrogen	Direct	58.8
Chemical oxygen demand (COD)	Direct	42.6
Fluoride	Direct	14.1
Nitrate/nitrite	Direct	7.29
Thiocyanate	Direct	0.116
Total Kjeldahl nitrogen (TKN)	Direct	51.6
Total organic carbon (TOC)	Direct	12.9
Total phenols	Direct	0.0431
Weak acid dissociable (WAD) cyanide	Direct	0.0179
Priority Metals		
Arsenic	Direct	0.00460
Cadmium	Direct	0.00627
Chromium	Direct	0.0151
Copper	Direct	0.00798
Lead	Direct	0.0374
Mercury	Direct	0.000221
Nickel	Direct	0.0159
Selenium	Direct	0.00701
Thallium	Direct	0.0577
Zinc	Direct	0.611
Nonconventional Metals		
Aluminum	Direct	0.586
Boron	Direct	0.363
Iron	Direct	2.62
Magnesium	Direct	27.1
Manganese	Direct	0.307

Table 11-13 (Continued)

Pollutant of Concern	Type of Discharge (a)	Subcategory-Specific Average Baseline Concentration (mg/L)
Nonconventional Metals (cont.)		
Molybdenum	Direct	0.0381
Titanium	Direct	0.00160
Priority Organic Pollutants		
2,4-Dimethylphenol	Direct	0.0100
Fluoranthene	Direct	0.0100
4-Nitrophenol	Direct	0.0500
Phenanthrene	Direct	0.0100
Phenol	Direct	0.0100
Nonconventional Organic Pollutants		
1,2,3,4,6,7,8-Heptachlorodibenzofuran	Direct	1.24E-07
1,2,3,4,7,8-Hexachlorodibenzofuran	Direct	9.40E-08
1,2,3,6,7,8-Hexachlorodibenzofuran	Direct	8.24E-08
2,3,4,6,7,8-Hexachlorodibenzofuran	Direct	6.80E-08
o-Cresol	Direct	0.0100
p-Cresol	Direct	0.0100
1,2,3,7,8-Pentachlorodibenzofuran	Direct	9.16E-08
2,3,4,7,8-Pentachlorodibenzofuran	Direct	1.27E-07
Pyridine	Direct	0.0215
2,3,7,8-Tetrachlorodibenzofuran	Direct	8.13E-08
Other Priority Pollutants		
Total cyanide	Direct	0.0696

(a) Sites with commingled blast furnace and sintering wastewater included only direct dischargers; therefore, EPA did not calculate average baseline pollutant concentrations for indirect dischargers.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Note: For sites with commingled blast furnace and sintering wastewater, EPA combined the POCs for the blast furnace and sintering segments.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-14

Minimum Levels Used as Treated Effluent Concentrations for the Sintering Subcategory (a)

Pollutant of Concern	Option	Minimum Level (mg/L)
Nonconventional Organic Pollutants		
1,2,3,4,6,7,8-Heptachlorodibenzofuran	BAT-1	5E-08
1,2,3,4,7,8-Hexachlorodibenzofuran	BAT-1	5E-08
1,2,3,6,7,8-Hexachlorodibenzofuran	BAT-1	5E-08
2,3,4,6,7,8-Hexachlorodibenzofuran	BAT-1	5E-08
1,2,3,7,8-Pentachlorodibenzofuran	BAT-1	5E-08
2,3,4,7,8-Pentachlorodibenzofuran	BAT-1	5E-08
2,3,7,8-Tetrachlorodibenzofuran	BAT-1	1E-08

(a) EPA calculated pollutant removals for only dioxins and furans for the sintering subcategory; therefore, for all other POCs, the treated effluent concentration was set equal to the baseline effluent concentration and LTAs were not needed for this calculation.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-15

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Sintering Subcategory Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	167,000	167,000	0
Total suspended solids (TSS)	456,000	456,000	0
Total Conventional Pollutants	**623,000**	**623,000**	**0**
Nonconventional Pollutants, Other (a)			
Amenable cyanide	685	685	0
Ammonia as nitrogen	1,720,000	1,720,000	0
Chemical oxygen demand (COD)	1,220,000	1,220,000	0
Fluoride	404,000	404,000	0
Nitrate/nitrite	206,000	206,000	0
Thiocyanate	3,320	3,320	0
Total Kjeldahl nitrogen (TKN)	1,470,000	1,470,000	0
Total organic carbon (TOC)	368,000	368,000	0
Total phenols	1,250	1,250	0
Weak acid dissociable (WAD) cyanide	510	510	0
Total Nonconventional Pollutants, Other (b)	**2,330,000**	**2,330,000**	**0**
Priority Metals			
Arsenic	135	135	0
Cadmium	185	185	0
Chromium	427	427	0
Copper	243	243	0
Lead	1,090	1,090	0
Mercury	6.34	6.34	0
Nickel	449	449	0
Selenium	213	213	0
Thallium	1,790	1,790	0
Zinc	18,300	18,300	0
Total Priority Metals	**22,800**	**22,800**	**0**
Nonconventional Metals			
Aluminum	16,800	16,800	0
Boron	10,600	10,600	0
Iron	74,300	74,300	0

Table 11-15 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Nonconventional Metals (cont.)			
Magnesium	775,000	775,000	0
Manganese	9,730	9,730	0
Molybdenum	1,080	1,080	0
Titanium	49.1	49.1	0
Total Nonconventional Metals	**888,000**	**888,000**	**0**
Priority Organic Pollutants			
2,4-Dimethylphenol	289	289	0
Fluoranthene	286	286	0
4-Nitrophenol	1,490	1,490	0
Phenanthrene	287	287	0
Phenol	289	289	0
Total Priority Organic Pollutants	**2,640**	**2,640**	**0**
Nonconventional Organic Pollutants			
2,3,7,8-Tetrachlorodibenzofuran	0.000616	0.000285	0.000332
1,2,3,7,8-Pentachlorodibenzofuran	0.00157	0.00142	0.000152
2,3,4,7,8-Pentachlorodibenzofuran	0.0017	0.00142	0.000281
1,2,3,4,7,8-Hexachlorodibenzofuran	0.00158	0.00142	0.000161
1,2,3,6,7,8-Hexachlorodibenzofuran	0.00154	0.00142	0.000118
2,3,4,6,7,8-Hexachlorodibenzofuran	0.00149	0.00142	0.0000658
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.00169	0.00142	0.000272
o-Cresol	285	285	0
p-Cresol	286	286	0
Pyridine	646	646	0
Total Nonconventional Organic Pollutants	**1,220**	**1,220**	**0.00138**
Other Priority Pollutants			
Total cyanide	1,940	1,940	0

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include amenable cyanide, COD, TKN, TOC, total phenols, or WAD cyanide.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-16

Subcategory-Specific Average Baseline Pollutant Concentrations for the Integrated Steelmaking Subcategory

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Total suspended solids (TSS)	Direct	15.8
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	Direct	0.375
Chemical oxygen demand (COD)	Direct	31.3
Fluoride	Direct	38.7
Nitrate/nitrite	Direct	1.04
Total organic carbon (TOC)	Direct	8.89
Priority Metals		
Cadmium	Direct	0.00493
Chromium	Direct	0.0102
Copper	Direct	0.0173
Lead	Direct	0.0694
Zinc	Direct	0.802
Nonconventional Metals		
Aluminum	Direct	1.07
Iron	Direct	4.41
Magnesium	Direct	21.6
Manganese	Direct	0.288
Molybdenum	Direct	0.387
Vanadium	Direct	0.0134
Tin	Direct	0.00746
Titanium	Direct	0.00716

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-17

Arithmetic Means of BAT Performance Data for the Integrated Steelmaking Subcategory

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Total suspended solids (TSS)	BAT-1	7.49
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	BAT-1	0.142
Chemical oxygen demand (COD)	BAT-1	21.2
Fluoride	BAT-1	15.5
Nitrate/nitrite	BAT-1	1.95
Total organic carbon (TOC)	BAT-1	9.14
Priority Metals		
Cadmium	BAT-1	0.00100
Chromium	BAT-1	0.0101
Copper	BAT-1	0.0100
Lead	BAT-1	0.0141
Zinc	BAT-1	0.121
Nonconventional Metals		
Aluminum	BAT-1	0.228
Iron	BAT-1	1.17
Magnesium	BAT-1	56.5
Manganese	BAT-1	0.0673
Molybdenum	BAT-1	0.656
Tin	BAT-1	0.00390
Titanium	BAT-1	0.00605
Vanadium	BAT-1	0.0145

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Table 11-18

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Integrated Steelmaking Subcategory Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Total suspended solids (TSS)	1,120,000	225,000	892,000
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	24,000	5,940	18,100
Chemical oxygen demand (COD)	2,670,000	714,000	1,960,000
Fluoride	2,720,000	591,000	2,130,000
Nitrate/nitrite	104,000	104,000	0
Total organic carbon (TOC)	716,000	246,000	470,000
Total Nonconventional Pollutants, Other (b)	**2,850,000**	**701,000**	**2,150,000**
Priority Metals			
Cadmium	249	37	211
Chromium	813	277	536
Copper	1,120	289	831
Lead	3,640	416	3,230
Zinc	41,200	3,330	37,900
Total Priority Metals	**47,000**	**4,350**	**42,700**
Nonconventional Metals			
Aluminum	62,800	9,800	53,000
Iron	279,000	38,700	240,000
Magnesium	2,550,000	725,000	1,830,000
Manganese	16,000	2,330	13,600
Molybdenum	33,200	11,000	22,300
Tin	523	144	379
Titanium	571	175	396
Vanadium	1,130	404	731
Total Nonconventional Metals	**2,940,000**	**788,000**	**2,160,000**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD or TOC.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-19

Subcategory-Specific Average Baseline Pollutant Concentrations for the Integrated and Stand-Alone Hot Forming Subcategory Carbon and Alloy Steel Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	6.98
	Indirect	6.98 (a)
Total suspended solids (TSS)	Direct	36.8
	Indirect	516
Nonconventional Pollutants, Other (b)		
Ammonia as nitrogen	Direct, Indirect	0.673
Chemical oxygen demand (COD)	Direct, Indirect	57.4
Fluoride	Direct, Indirect	4.37
Total petroleum hydrocarbons (TPH)	Direct, Indirect	6.95
Priority Metals		
Lead	Direct, Indirect	0.0197
Zinc	Direct, Indirect	0.0754
Nonconventional Metals		
Iron	Direct, Indirect	8.28
Manganese	Direct, Indirect	0.0648
Molybdenum	Direct, Indirect	0.0544

(a) For this conventional pollutant, no data were available for the indirect site; therefore, EPA used the average baseline concentration for the direct discharging sites.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-20

Subcategory-Specific Average Baseline Pollutant Concentrations for the Integrated and Stand-Alone Hot Forming Subcategory Stainless Steel Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Indirect	39.8
Total suspended solids (TSS)	Indirect	71.8
Nonconventional Pollutants, Other (a)		
Chemical oxygen demand (COD)	Indirect	173
Fluoride	Indirect	5.85
Total organic carbon (TOC)	Indirect	47.7
Total petroleum hydrocarbons (TPH)	Indirect	8.50
Priority Metals		
Antimony	Indirect	0.101
Chromium	Indirect	0.0815
Copper	Indirect	0.0861
Nickel	Indirect	1.02
Zinc	Indirect	2.90
Nonconventional Metals		
Iron	Indirect	3.43
Manganese	Indirect	0.400
Molybdenum	Indirect	7.21
Titanium	Indirect	0.00651

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-21

Arithmetic Means of BAT Performance Data for the Integrated and Stand-Alone Hot Forming Subcategory Carbon and Alloy Steel Segment

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	BAT-1, PSES-1	6.58 (a)
Total suspended solids (TSS)	BAT-1, PSES-1	9.88 (a)
Nonconventional Pollutants, Other (b)		
Ammonia as nitrogen	BAT-1, PSES-1	0.615
Chemical oxygen demand (COD)	BAT-1, PSES-1	36.5
Fluoride	BAT-1, PSES-1	1.33
Total petroleum hydrocarbons (TPH)	BAT-1, PSES-1	5.69
Priority Metals		
Lead	BAT-1, PSES-1	0.0120
Zinc	BAT-1, PSES-1	0.0879 (a)
Nonconventional Metals		
Iron	BAT-1, PSES-1	2.45
Manganese	BAT-1, PSES-1	0.0308
Molybdenum	BAT-1, PSES-1	0.0890

(a) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-22

Arithmetic Means of BAT Performance Data for the Integrated and Stand-Alone Hot Forming Subcategory Stainless Steel Segment (a)

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	PSES-1	9.20 (b)
Total suspended solids (TSS)	PSES-1	7.27 (b)
Nonconventional Pollutants, Other (c)		
Chemical oxygen demand (COD)	PSES-1	44.6
Total organic carbon (TOC)	PSES-1	11.2
Fluoride	PSES-1	14.9
Total petroleum hydrocarbons (TPH)	PSES-1	7.13
Priority Metals		
Antimony	PSES-1	0.260
Chromium	PSES-1	0.0251 (c)
Copper	PSES-1	0.00904
Nickel	PSES-1	0.108 (c)
Zinc	PSES-1	0.0710
Nonconventional Metals		
Iron	PSES-1	0.658
Manganese	PSES-1	0.0492
Molybdenum	PSES-1	1.23
Titanium	PSES-1	0.00900

(a) EPA transferred LTAs for this segment from the stainless segment of the non-integrated steelmaking and hot forming subcategory.
(b) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.
(c) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-23

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Integrated and Stand-Alone Hot Forming Subcategory Carbon and Alloy Steel Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	7,520,000	357,000	7,170,000
Total suspended solids (TSS)	28,900,000	799,000	28,100,000
Total Conventional Pollutants	**36,400,000**	**1,160,000**	**35,300,000**
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	700,000	36,200	664,000
Chemical oxygen demand (COD)	50,500,000	2,180,000	48,300,000
Fluoride	4,440,000	93,800	4,340,000
Total petroleum hydrocarbons (TPH)	7,420,000	318,000	7,100,000
Total Nonconventional Pollutants, Other (b)	**5,140,000**	**130,000**	**5,000,000**
Priority Metals			
Lead	20,400	767	19,600
Zinc	75,900	3,320	72,600
Total Priority Metals	**96,300**	**4,090**	**92,200**
Nonconventional Metals			
Iron	7,330,000	165,000	7,170,000
Manganese	69,300	1,920	67,400
Molybdenum	55,800	2,540	53,200
Total Nonconventional Metals	**7,460,000**	**169,000**	**7,290,000**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD or TPH.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-24

Summary of Baseline and Treated Pollutant Loadings and Removals for the Integrated and Stand-Alone Hot Forming Subcategory Carbon and Alloy Steel Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	393	191	202
Chemical oxygen demand (COD)	10,400	4,550	5,880
Fluoride	1,920	723	1,200
Total petroleum hydrocarbons (TPH)	864	405	459
Total Nonconventional Pollutants, Other (b)	**2,310**	**914**	**1,400**
Priority Metals			
Lead	1.99	1.55	0.438
Zinc	16.7	8.01	8.7
Total Priority Metals	**18.7**	**9.56**	**9.14**
Nonconventional Metals			
Iron	4,710	534	4,170
Manganese	39.6	16.1	23.5
Molybdenum	42.1	21.1	21
Total Nonconventional Metals	**4,790**	**571**	**4,210**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD or TPH.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-25

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Integrated and Stand-Alone Hot Forming Subcategory Stainless Steel Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Chemical oxygen demand (COD)	4,780	339	4,440
Fluoride	392	38.8	353
Total organic carbon (TOC)	2,080	48.6	2,040
Total petroleum hydrocarbons (TPH)	161	15	146
Total Nonconventional Pollutants, Other (b)	**392**	**38.8**	**353**
Priority Metals			
Antimony	4.86	0.481	4.38
Chromium	2.38	0.0724	2.3
Copper	2.01	0.0209	1.99
Nickel	72.5	0.764	71.7
Zinc	88.8	5.51	83.3
Total Priority Metals	**171**	**6.85**	**164**
Nonconventional Metals			
Iron	89.9	6.15	83.8
Manganese	37.4	2.46	34.9
Molybdenum	851	57.6	794
Titanium	0.076	0.00751	0.0684
Total Nonconventional Metals	**978**	**66.2**	**913**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, or TOC.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-26
Subcategory-Specific Average Baseline Pollutant Concentrations for the Non-Integrated Steelmaking and Hot Forming Subcategory Carbon and Alloy Steel Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	5.11
	Indirect	13.7
Total suspended solids (TSS)	Direct	17.7
	Indirect	24.0
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	Direct, Indirect	0.267
Chemical oxygen demand (COD)	Direct, Indirect	68.8
Fluoride	Direct, Indirect	0.41
Nitrate/nitrite	Direct, Indirect	0.2
Total organic carbon (TOC)	Direct, Indirect	16.4
Total petroleum hydrocarbons (TPH)	Direct, Indirect	4.16
Priority Metals		
Copper	Direct, Indirect	0.0794
Lead	Direct, Indirect	0.0187
Zinc	Direct, Indirect	0.0862
Nonconventional Metals		
Boron	Direct, Indirect	0.0766
Iron	Direct, Indirect	2.61
Manganese	Direct, Indirect	0.304
Molybdenum	Direct, Indirect	0.0318

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-27

Subcategory-Specific Average Baseline Pollutant Concentrations for the Non-Integrated Steelmaking and Hot Forming Subcategory Stainless Steel Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	7.28
	Indirect	31.3
Total suspended solids (TSS)	Direct	11.9
	Indirect	53.4
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	Direct, Indirect	0.688
Chemical oxygen demand (COD)	Direct, Indirect	125
Fluoride	Direct, Indirect	48.6
Nitrate/nitrite	Direct, Indirect	2.75
Total organic carbon (TOC)	Direct, Indirect	36.9
Total petroleum hydrocarbons (TPH)	Direct	7.28(b)
	Indirect	7.39
Priority Metals		
Antimony	Direct, Indirect	0.0653
Chromium	Direct, Indirect	0.180
Copper	Direct, Indirect	0.0807
Lead	Direct, Indirect	0.0415
Nickel	Direct, Indirect	0.783
Zinc	Direct, Indirect	1.71
Nonconventional Metals		
Aluminum	Direct, Indirect	0.514
Boron	Direct, Indirect	1.05
Hexavalent chromium	Direct, Indirect	0.0852
Iron	Direct, Indirect	3.87
Manganese	Direct, Indirect	0.333
Molybdenum	Direct, Indirect	8.16

Table 11-27 (Continued)

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Nonconventional Metals (cont.)		
Titanium	Direct, Indirect	0.0069

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) The O&G average concentration for direct discharging sites was used as the TPH average concentration for direct discharging sites because the average baseline concentration for TPH was greater than the O&G average baseline concentration. A pollutant within a bulk parameter cannot be greater than the bulk parameter.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-28

LTAs for the Non-Integrated Steelmaking and Hot Forming Subcategory Carbon and Alloy Steel Segment

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	BAT-1, PSES-1	8.43
Total suspended solids (TSS)	BAT-1, PSES-1	16.7
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	BAT-1, PSES-1	0.615
Chemical oxygen demand (COD)	BAT-1, PSES-1	36.5
Fluoride	BAT-1, PSES-1	1.33
Nitrate/nitrite	BAT-1, PSES-1	(b)
Total organic carbon (TOC)	BAT-1, PSES-1	(b)
Total petroleum hydrocarbons (TPH)	BAT-1, PSES-1	5.69
Priority Metals		
Copper	BAT-1, PSES-1	(b)
Lead	BAT-1, PSES-1	0.00590
Zinc	BAT-1, PSES-1	0.0746
Nonconventional Metals		
Boron	BAT-1, PSES-1	(b)
Iron	BAT-1, PSES-1	4.06
Manganese	BAT-1, PSES-1	0.0308
Molybdenum	BAT-1, PSES-1	0.0890

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) EPA did not calculate an arithmetic mean of BAT performance data for this POC due to a lack of applicable effluent data.

Table 11-29

Arithmetic Means of BAT Performance Data for the Non-Integrated Steelmaking and Hot Forming Subcategory Stainless Steel Segment

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	BAT-1, PSES-1	8.78
Total suspended solids (TSS)	BAT-1, PSES-1	6.36
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	BAT-1, PSES-1	0.200
Chemical oxygen demand (COD)	BAT-1, PSES-1	44.6
Fluoride	BAT-1, PSES-1	14.9
Nitrate/nitrite	BAT-1, PSES-1	0.0571
Total organic carbon (TOC)	BAT-1, PSES-1	11.2
Total petroleum hydrocarbons (TPH)	BAT-1, PSES-1	7.13
Priority Metals		
Antimony	BAT-1, PSES-1	0.255
Chromium	BAT-1, PSES-1	0.0251 (b)
Copper	BAT-1, PSES-1	0.00904
Lead	BAT-1, PSES-1	0.0143
Nickel	BAT-1, PSES-1	0.108 (b)
Zinc	BAT-1, PSES-1	0.0846
Nonconventional Metals		
Aluminum	BAT-1, PSES-1	0.109
Boron	BAT-1, PSES-1	0.292
Hexavalent chromium	BAT-1, PSES-1	0.0164
Iron	BAT-1, PSES-1	0.558
Manganese	BAT-1, PSES-1	0.0492
Molybdenum	BAT-1, PSES-1	1.23
Titanium	BAT-1, PSES-1	0.00900

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-30

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Non-Integrated Steelmaking and Hot Forming Subcategory Carbon and Alloy Steel Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	747,000	85,300	662,000
Total suspended solids (TSS)	2,430,000	237,000	2,190,000
Total Conventional Pollutants	**3,180,000**	**322,000**	**2,850,000**
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	37,700	4,360	33,300
Chemical oxygen demand (COD)	9,550,000	926,000	8,620,000
Fluoride	57,100	6,440	50,600
Nitrate/nitrite	27,800	27,800	0
Total organic carbon (TOC)	2,270,000	2,270,000	0
Total petroleum hydrocarbons (TPH)	571,000	60,700	510,000
Total Nonconventional Pollutants, Other (b)	**123,000**	**38,600**	**83,900**
Priority Metals			
Copper	11,100	11,100	0
Lead	2,470	193	2,280
Zinc	11,400	1,080	10,300
Total Priority Metals	**25,000**	**12,400**	**12,600**
Nonconventional Metals			
Boron	10,700	10,700	0
Iron	362,000	41,600	320,000
Manganese	43,100	3,770	39,300
Molybdenum	4,420	498	3,920
Total Nonconventional Metals	**420,000**	**56,600**	**363,000**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, or TOC.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-31

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Non-Integrated Steelmaking and Hot Forming Subcategory Stainless Steel Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	12,800	6,650	6,140
Total suspended solids (TSS)	21,300	10,300	11,000
Total Conventional Pollutants	**34,100**	**17,000**	**17,100**
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	1,170	551	618
Chemical oxygen demand (COD)	213,000	102,000	111,000
Fluoride	82,100	44,400	37,700
Nitrate/nitrite	4,270	2,120	2,150
Total organic carbon (TOC)	63,700	30,300	33,400
Total petroleum hydrocarbons (TPH)	12,500	6,460	6,020
Total Nonconventional Pollutants, Other (b)	**87,500**	**47,100**	**40,500**
Priority Metals			
Antimony	126	73.9	52.1
Chromium	296	156	140
Copper	130	64.2	65.5
Lead	64	31.7	32.3
Nickel	1,250	611	637
Zinc	2,810	1,310	1,510
Total Priority Metals	**4,680**	**2,250**	**2,440**
Nonconventional Metals			
Aluminum	873	447	426
Boron	1,800	931	870
Hexavalent chromium	143	76.3	66.6
Iron	6,130	3,110	3,020
Manganese	538	261	277
Molybdenum	13,700	6,480	7,200

Table 11-31 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Nonconventional Metals (cont.)			
Titanium	12.1	6.43	5.69
Total Nonconventional Metals	**23,200**	**11,300**	**11,900**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, or TOC.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-32

Summary of Baseline and Treated Pollutant Loadings for the Non-Integrated Steelmaking and Hot Forming Subcategory Carbon and Alloy Steel Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	815	629	186
Chemical oxygen demand (COD)	65,400	43,200	22,200
Fluoride	946	730	216
Nitrate/nitrite	100	100	0
Total organic carbon (TOC)	24,700	24,700	0
Total petroleum hydrocarbons (TPH)	2,710	2,090	618
Total Nonconventional Pollutants, Other (b)	**1,860**	**1,460**	**402**
Priority Metals			
Copper	58.4	58.4	0
Lead	22.6	12.8	9.71
Zinc	122	64	57.9
Total Priority Metals	**203**	**135**	**67.6**
Nonconventional Metals			
Boron	292	292	0
Iron	2,310	1,800	518
Manganese	976	541	434
Molybdenum	230	201	29.4
Total Nonconventional Metals	**3,810**	**2,830**	**981**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, or TOC.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-33

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Non-Integrated Steelmaking and Hot Forming Subcategory Stainless Steel Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	422	30.9	391
Chemical oxygen demand (COD)	22,800	1,770	21,000
Fluoride	20,500	1,460	19,000
Nitrate/nitrite	288	17.1	271
Total organic carbon (TOC)	10,700	805	9,900
Total petroleum hydrocarbons (TPH)	906	80.7	826
Total Nonconventional Pollutants, Other (b)	**21,200**	**1,510**	**19,700**
Priority Metals			
Antimony	19.7	1.6	18.1
Chromium	32.9	1.59	31.3
Copper	12	0.612	11.3
Lead	9.43	0.478	8.96
Nickel	357	23.9	333
Zinc	334	15.2	319
Total Priority Metals	**765**	**43.4**	**722**
Nonconventional Metals			
Aluminum	43.6	3.25	40.3
Boron	749	58.4	691
Hexavalent chromium	72.2	3.82	68.4
Iron	657	45.9	611
Manganese	204	14.4	190
Molybdenum	6,570	447	6,120
Titanium	0.524	0.0508	0.473
Total Nonconventional Metals	**8,300**	**573**	**7,720**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, or TOC.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-34

Subcategory-Specific Average Baseline Pollutant Concentrations for the Steel Finishing Subcategory Carbon and Alloy Steel Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	nd
	Indirect	nd
Total suspended solids (TSS)	Direct	nd
	Indirect	nd
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	Direct, Indirect	2.00
Chemical oxygen demand (COD)	Direct, Indirect	106
Fluoride	Direct, Indirect	0.931
Nitrate/nitrite	Direct, Indirect	0.700
Total organic carbon (TOC)	Direct, Indirect	31.8
Total petroleum hydrocarbons (TPH)	Direct, Indirect	6.02
Total phenols	Direct, Indirect	0.125
Priority Metals		
Antimony	Direct, Indirect	0.0249
Arsenic	Direct, Indirect	0.00632
Chromium	Direct, Indirect	0.0334
Copper	Direct, Indirect	0.0475
Lead	Direct, Indirect	0.0191
Nickel	Direct, Indirect	0.235
Zinc	Direct, Indirect	0.143
Nonconventional Metals		
Aluminum	Direct, Indirect	0.354
Boron	Direct, Indirect	0.0763
Hexavalent chromium	Direct, Indirect	0.0204
Iron	Direct, Indirect	0.854
Manganese	Direct, Indirect	0.0575
Molybdenum	Direct, Indirect	0.0311
Tin	Direct, Indirect	0.0438
Titanium	Direct, Indirect	0.00420

Table 11-34 (Continued)

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Priority Organic Pollutants		
Bis(2-ethylhexyl) phthalate	Direct, Indirect	0.0184
Nonconventional Organic Pollutants		
alpha-Terpineol	Direct, Indirect	0.0310
n-Dodecane	Direct, Indirect	0.0199
n-Hexadecane	Direct, Indirect	0.0193
2-Propanone	Direct, Indirect	0.139

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

nd - This information is not disclosed to prevent compromising confidential business information.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-35

Subcategory-Specific Average Baseline Pollutant Concentrations for the Steel Finishing Subcategory Stainless Steel Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	nd
	Indirect	nd
Total suspended solids (TSS)	Direct	nd
	Indirect	nd
Nonconventional Pollutants, Other (a)		
Ammonia as nitrogen	Direct, Indirect	18.0
Chemical oxygen demand (COD)	Direct, Indirect	44.3
Fluoride	Direct, Indirect	112
Nitrate/nitrite	Direct, Indirect	506
Total organic carbon (TOC)	Direct, Indirect	10.2
Total petroleum hydrocarbons (TPH)	Direct, Indirect	6.20
Total phenols	Direct, Indirect	0.0517
Priority Metals		
Antimony	Direct, Indirect	0.0140
Arsenic	Direct, Indirect	0.00489
Chromium	Direct, Indirect	0.138
Copper	Direct, Indirect	0.0218
Lead	Direct, Indirect	0.0282
Nickel	Direct, Indirect	0.278
Zinc	Direct, Indirect	0.0315
Nonconventional Metals		
Aluminum	Direct, Indirect	0.0730
Barium	Direct, Indirect	0.0179
Boron	Direct, Indirect	0.142
Cobalt	Direct, Indirect	0.0114
Hexavalent chromium	Direct, Indirect	0.0335
Iron	Direct, Indirect	0.947
Magnesium	Direct, Indirect	21.7
Manganese	Direct, Indirect	0.136

Table 11-35 (Continued)

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Nonconventional Metals (cont.)		
Molybdenum	Direct, Indirect	0.449
Tin	Direct, Indirect	0.00340
Titanium	Direct, Indirect	0.00440
Nonconventional Organic Pollutants		
Hexanoic acid	Direct, Indirect	0.0150
n-Dodecane	Direct, Indirect	0.0189
n-Hexadecane	Direct, Indirect	0.0258
2-Propanone	Direct, Indirect	0.0502
Other Priority Pollutants		
Total cyanide	Direct, Indirect	0.608

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

nd - This information is not disclosed to prevent compromising confidential business information.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-36

Arithmetic Means of BAT Performance Data for the Steel Finishing Subcategory Carbon and Alloy Steel Segment

Pollutant of Concern	Type of Operation (a)	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants			
Oil and grease (O&G)	All	BAT-1, PSES-1	12.1
Total suspended solids (TSS)	All	BAT-1, PSES-1	12.8
Nonconventional Pollutants, Other (b)			
Ammonia as nitrogen	All	BAT-1, PSES-1	1.81
Chemical oxygen demand (COD)	All	BAT-1, PSES-1	131
Fluoride	All	BAT-1, PSES-1	0.780
Nitrate/nitrite	All	BAT-1, PSES-1	0.476
Total organic carbon (TOC)	All	BAT-1, PSES-1	36.6
Total petroleum hydrocarbons (TPH)	All	BAT-1, PSES-1	6.29
Total phenols	All	BAT-1, PSES-1	0.0754
Priority Metals			
Antimony	All	BAT-1, PSES-1	0.0133
Arsenic	All	BAT-1, PSES-1	0.00169
Chromium	All	BAT-1, PSES-1	0.0144
Copper	All	BAT-1, PSES-1	0.0122
Lead	All	BAT-1, PSES-1	0.00654
Nickel	All	BAT-1, PSES-1	0.0314
Zinc	All	BAT-1, PSES-1	0.0718
Nonconventional Metals			
Aluminum	All	BAT-1, PSES-1	0.0876
Boron	All	BAT-1, PSES-1	0.0937
Hexavalent chromium	All	BAT-1, PSES-1	0.0104
Iron	All	BAT-1, PSES-1	0.667
Manganese	All	BAT-1, PSES-1	0.0799
Molybdenum	All	BAT-1, PSES-1	0.0225
Tin	All	BAT-1, PSES-1	0.00833

Table 11-36 (Continued)

Pollutant of Concern	Type of Operation (a)	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Nonconventional Metals (cont.)			
Titanium	All	BAT-1, PSES-1	0.00433
Priority Organic Pollutants			
Bis(2-ethylhexyl) phthalate	All	BAT-1, PSES-1	0.0100
Nonconventional Organic Pollutants			
alpha-Terpineol	All	BAT-1, PSES-1	0.0321
n-Dodecane	All	BAT-1, PSES-1	0.0105
n-Hexadecane	All	BAT-1, PSES-1	0.0117
2-Propanone	All	BAT-1, PSES-1	0.185

(a) Operation types include: acid pickling, alkaline cleaning, annealing, cold forming, descaling, electroplating, and hot dip coating.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Table 11-37

Arithmetic Means of BAT Performance Data for the Steel Finishing Subcategory Stainless Steel Segment

Pollutant of Concern	Type of Operation (a)	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants			
Oil and grease (O&G)	All	BAT-1, PSES-1	6.20 (b)
Total suspended solids (TSS)	All	BAT-1, PSES-1	3.42
Nonconventional Pollutants, Other (c)			
Ammonia as nitrogen	All	BAT-1, PSES-1	11.7 (b)
Chemical oxygen demand (COD)	All	BAT-1, PSES-1	14.4
Fluoride	All	BAT-1, PSES-1	16.3 (b)
Nitrate/nitrite	All	BAT-1, PSES-1	93.9
Total organic carbon (TOC)	All	BAT-1, PSES-1	3.43
Total petroleum hydrocarbons (TPH)	All	BAT-1, PSES-1	5.89
Total phenols	All	BAT-1, PSES-1	0.0500
Priority Metals			
Antimony	All	BAT-1, PSES-1	0.00691
Arsenic	All	BAT-1, PSES-1	0.00173
Chromium	All	BAT-1, PSES-1	0.104 (b)
Copper	All	BAT-1, PSES-1	0.0231
Lead	All	BAT-1, PSES-1	0.00250
Nickel	All	BAT-1, PSES-1	0.0436 (b)
Zinc	All	BAT-1, PSES-1	0.00474
Nonconventional Metals			
Aluminum	All	BAT-1, PSES-1	0.0763
Barium	All	BAT-1, PSES-1	0.00833
Boron	All	BAT-1, PSES-1	0.151
Cobalt	All	BAT-1, PSES-1	0.0120
Hexavalent chromium	All	BAT-1, PSES-1	0.0800 (b)
Iron	All	BAT-1, PSES-1	0.0693
Magnesium	All	BAT-1, PSES-1	1.32
Manganese	All	BAT-1, PSES-1	0.00100
Molybdenum	All	BAT-1, PSES-1	1.03
Tin	All	BAT-1, PSES-1	0.00300
Titanium	All	BAT-1, PSES-1	0.00400

Table 11-37 (Continued)

Pollutant of Concern	Type of Operation (a)	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Nonconventional Organic Pollutants			
Hexanoic acid	All	BAT-1, PSES-1	0.028
n-Dodecane	All	BAT-1, PSES-1	0.0421
n-Hexadecane	All	BAT-1, PSES-1	0.0669
2-Propanone	All	BAT-1, PSES-1	0.05
Other Priority Pollutants			
Total cyanide	All	BAT-1, PSES-1	0.0160

(a) Operation types include: acid pickling, alkaline cleaning, annealing, cold forming, descaling, electroplating, and hot dip coating.
(b) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.
(c) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-38

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Steel Finishing Subcategory Carbon and Alloy Steel Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	2,030,000	1,090,000	943,000
Total suspended solids (TSS)	1,900,000	990,000	910,000
Total Conventional Pollutants	**3,930,000**	**2,080,000**	**1,850,000**
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	465,000	258,000	206,000
Chemical oxygen demand (COD)	22,300,000	11,800,000	10,500,000
Fluoride	234,000	102,000	133,000
Nitrate/nitrite	329,000	81,200	248,000
Total organic carbon (TOC)	6,460,000	3,310,000	3,150,000
Total petroleum hydrocarbons (TPH)	1,340,000	754,000	586,000
Total phenols	27,300	14,600	12,700
Total Nonconventional Pollutants, Other (b)	**1,030,000**	**441,000**	**587,000**
Priority Metals			
Antimony	5,250	2,660	2,590
Arsenic	1,260	598	660
Chromium	8,320	4,990	3,330
Copper	8,880	3,990	4,900
Lead	3,870	2,100	1,770
Nickel	46,200	21,700	24,500
Zinc	25,000	10,300	14,800
Total Priority Metals	**98,800**	**46,300**	**52,600**
Nonconventional Metals			
Aluminum	70,100	33,000	37,100
Boron	16,100	8,520	7,580
Hexavalent chromium	4,030	2,000	2,020
Iron	181,000	91,900	89,300
Manganese	12,200	6,480	5,750
Molybdenum	6,330	3,030	3,300

Table 11-38 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Nonconventional Metals (cont.)			
Tin	8,680	4,090	4,600
Titanium	939	529	409
Total Nonconventional Metals	**299,000**	**150,000**	**150,000**
Priority Organic Pollutants			
Bis(2-ethylhexyl) phthalate	3,800	1,930	1,870
Nonconventional Organic Pollutants			
alpha-Terpineol	6,290	3,210	3,070
n-Dodecane	4,100	2,080	2,020
n-Hexadecane	4,060	2,100	1,960
2-Propanone	28,500	14,700	13,900
Total Nonconventional Organic Pollutants	**43,000**	**22,100**	**21,000**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, TOC, or total phenols.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-39

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Steel Finishing Subcategory Stainless Steel Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	373,000	185,000	188,000
Total suspended solids (TSS)	998,000	342,000	656,000
Total Conventional Pollutants	**1,370,000**	**527,000**	**844,000**
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	945,000	381,000	564,000
Chemical oxygen demand (COD)	2,250,000	793,000	1,460,000
Fluoride	5,270,000	1,680,000	3,580,000
Nitrate/nitrite	25,100,000	8,060,000	17,100,000
Total organic carbon (TOC)	518,000	185,000	333,000
Total petroleum hydrocarbons (TPH)	317,000	166,000	151,000
Total phenols	2,640	1,400	1,240
Total Nonconventional Pollutants, Other (b)	**31,300,000**	**10,100,000**	**21,200,000**
Priority Metals			
Antimony	702	282	420
Arsenic	211	88.5	122
Chromium	6,990	3,020	3,970
Copper	1,160	592	571
Lead	1,070	405	666
Nickel	12,800	4,160	8,680
Zinc	1,270	484	788
Total Priority Metals	**24,200**	**9,030**	**15,200**
Nonconventional Metals			
Aluminum	3,750	1,990	1,750
Barium	902	355	547
Boron	7,290	3,630	3,660
Cobalt	587	316	271
Hexavalent chromium	1,960	825	1,140
Iron	43,400	13,500	29,900

Table 11-39 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	BAT-1 Treated Load Discharged to Surface Water (lbs/yr)	BAT-1 Pollutant Removals (lbs/yr)
Nonconventional Metals (cont.)			
Magnesium	1,090,000	306,000	783,000
Manganese	7,110	1,820	5,290
Molybdenum	23,900	11,800	12,000
Tin	174	87.8	86
Titanium	225	115	110
Total Nonconventional Metals	**1,180,000**	**340,000**	**838,000**
Nonconventional Organic Pollutants			
n-Dodecane	992	504	488
n-Hexadecane	1,370	682	683
Hexanoic acid	782	404	378
2-Propanone	2,570	1,380	1,190
Total Nonconventional Organic Pollutants	**5,710**	**2,970**	**2,740**
Other Priority Pollutants			
Total cyanide	29,900	8,300	21,600

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, TOC, or total phenols.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-40

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Steel Finishing Subcategory Carbon and Alloy Steel Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	10,400	7,280	3,100
Chemical oxygen demand (COD)	168,000	118,000	50,000
Fluoride	3,700	2,610	1,090
Nitrate/nitrite	586	407	178
Total organic carbon (TOC)	79,700	55,400	24,200
Total petroleum hydrocarbons (TPH)	6,840	4,850	1,990
Total phenols	239	166	73.5
Total Nonconventional Pollutants, Other (b)	**14,700**	**10,300**	**4,370**
Priority Metals			
Antimony	71.6	50.6	21
Arsenic	21.6	15.1	6.57
Chromium	53.9	37.4	16.6
Copper	84.9	53.7	31.1
Lead	37.2	25.8	11.5
Nickel	931	652	279
Zinc	247	174	73
Total Priority Metals	**1,450**	**1,010**	**439**
Nonconventional Metals			
Aluminum	265	184	81.5
Boron	500	353	147
Hexavalent chromium	161	112	48.6
Iron	1,270	882	392
Manganese	308	215	93.6
Molybdenum	226	162	64.1
Tin	270	206	64
Titanium	2.9	2.05	0.854
Total Nonconventional Metals	**3,000**	**2,120**	**892**

Table 11-40 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Priority Organic Pollutants			
Bis(2-ethylhexyl) phthalate	122	103	18.8
Nonconventional Organic Pollutants			
alpha-Terpineol	17.2	12.5	4.74
n-Dodecane	9.74	7.2	2.53
n-Hexadecane	55.2	40.9	14.3
2-Propanone	187	131	56.6
Total Nonconventional Organic Pollutants	**269**	**192**	**78.2**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, TOC, or total phenols.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-41

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Steel Finishing Subcategory Stainless Steel Segment Indirect Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	22,700	15,400	7,320
Chemical oxygen demand (COD)	17,400	10,300	7,110
Fluoride	113,000	58,000	55,200
Nitrate/nitrite	105,000	58,300	46,600
Total organic carbon (TOC)	6,360	3,780	2,580
Total petroleum hydrocarbons (TPH)	1,670	1,260	409
Total phenols	24.6	18.7	5.92
Total Nonconventional Pollutants, Other (b)	**241,000**	**132,000**	**109,000**
Priority Metals			
Antimony	9.54	6.07	3.47
Arsenic	3.79	2.06	1.73
Chromium	70.3	22.7	47.7
Copper	6.15	4.49	1.66
Lead	39.6	24.2	15.4
Nickel	147	39.1	108
Zinc	26.4	13.1	13.4
Total Priority Metals	**303**	**112**	**191**
Nonconventional Metals			
Aluminum	13.6	10.4	3.16
Barium	16.7	10.5	6.18
Boron	224	172	51.9
Cobalt	21.3	16.4	4.94
Hexavalent chromium	65.1	50	15.1
Iron	694	527	167
Magnesium	38,500	20,200	18,400
Manganese	116	27.7	88.3
Molybdenum	753	578	175

Table 11-41 (Continued)

Pollutant of Concern	Baseline Load (lbs/yr)	PSES-1 Treated Load Discharged from POTW (lbs/yr)	PSES-1 Pollutant Removals (lbs/yr)
Nonconventional Metals (cont.)			
Tin	4.01	2.96	1.05
Titanium	0.728	0.542	0.186
Total Nonconventional Metals	**40,400**	**21,600**	**18,900**
Nonconventional Organic Pollutants			
n-Dodecane	1.96	1.5	0.454
n-Hexadecane	15.5	11.9	3.6
Hexanoic acid	4.97	3.81	1.15
2-Propanone	16.6	12.7	3.87
Total Nonconventional Organic Pollutants	**39.0**	**29.9**	**9.07**
Other Priority Pollutants			
Total cyanide	325	194	132

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD, TPH, TOC, or total phenols.

Note: Survey weights and POTW percent removals were applied to the pollutant loadings and removals presented in this table (i.e., represents what is discharged to the receiving stream).

Table 11-42

Subcategory-Specific Average Baseline Pollutant Concentrations for the Other Operations Subcategory Forging Segment

Pollutant of Concern	Type of Discharge	Subcategory-Specific Average Baseline Concentration (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	Direct	3.35
Total suspended solids (TSS)	Direct	32.10

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-43

Arithmetic Means of BAT Performance Data for the Other Operations Subcategory DRI Segment

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Total suspended solids (TSS)	BPT	7.51 (a)
Nonconventional Pollutants, Other (b)		
Ammonia as nitrogen	BPT	13.4
Chemical oxygen demand (COD)	BPT	15.6
Fluoride	BPT	14.2
Nonconventional Metals		
Aluminum	BPT	0.0403
Iron	BPT	2.40
Manganese	BPT	1.25

(a) EPA's statisticians calculated this LTA at proposal. The statisticians calculated the LTAs for regulated pollutants only.
(b) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-44

Arithmetic Means of BAT Performance Data for the Other Operations Subcategory Forging Segment

Pollutant of Concern	Option	Arithmetic Mean of BAT Performance Data (mg/L)
Conventional Pollutants		
Oil and grease (O&G)	BPT	7.78
Total suspended solids (TSS)	BPT	6.50

Sources: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys), U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (Analytical and Production Survey), and U.S. EPA Iron and Steel Industry Wastewater Sampling Program, 1997-1999.

Table 11-45

Summary of Baseline and Treated Pollutant Loadings and Pollutant Removals for the Other Operations Subcategory DRI Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BPT Treated Load Discharged to Surface Water (lbs/yr)	BPT Pollutant Removals (lbs/yr)
Conventional Pollutants			
Total suspended solids (TSS)	4,580	3,190	1,380
Nonconventional Pollutants, Other (a)			
Ammonia as nitrogen	8,270	5,770	2,500
Chemical oxygen demand (COD)	9,630	6,720	2,910
Fluoride	8,770	6,120	2,650
Total Nonconventional Pollutants, Other (b)	**17,000**	**11,900**	**5,150**
Nonconventional Metals			
Aluminum	24.9	17.4	7.52
Iron	968	676	293
Manganese	772	538	233
Total Nonconventional Metals	**1,760**	**1,230**	**534**

(a) Nonconventional pollutants other than nonconventional metals and nonconventional organic pollutants.
(b) Total does not include COD.

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.

Table 11-46

Summary of Baseline and Treated Pollutant Loadings Pollutant Removals for the Other Operations Subcategory Forging Segment Direct Dischargers

Pollutant of Concern	Baseline Load (lbs/yr)	BPT Treated Load Discharged to Surface Water (lbs/yr)	BPT Pollutant Removals (lbs/yr)
Conventional Pollutants			
Oil and grease (O&G)	480	352	129
Total suspended solids (TSS)	5,990	2,560	3,440
Total Conventional Pollutants	**6,470**	**2,910**	**3,570**

Note: Survey weights were applied to the pollutant loadings and removals presented in this table.